



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

SEP 21 2000

REPLY TO THE ATTENTION OF: SE-5J

ACTION MEMORANDUM

**SUBJECT:** Request for a Time-Critical Removal Action approval at the Western Mineral Products Site in Minneapolis, Hennepin County, Minnesota (Site ID # B5P2).

**FROM:** Leonard N. Zintak, Jr., On-Scene Coordinator  
Emergency Response Section 3

**TO:** William E. Muno, Director  
Superfund Division

**THRU:** -Richard C. Karl, Chief  
Emergency Response Branch

**I. PURPOSE**

The purpose of this action memorandum is to request and document approval to expend up to \$898,200 to conduct a time-critical removal action at the Western Mineral Products Site located in Minneapolis, Hennepin County, Minnesota. Specifically, the proposed removal action will address the contaminated residential properties surrounding the industrial portion of the site.

This removal action addresses the need to mitigate the threats to the local population and the environment posed by fibrous amphibole asbestos that was released into the environment from the industrial portion of the site as a result of the processing of vermiculite ore and disposal of associated waste products. High concentrations of amphibole asbestos posing a public health threat have been detected on and in the areas surrounding the former Western Mineral Products/W.R. Grace property and on the adjacent Electramatic property. These properties are herein referred to as the industrial sites. Also, high concentrations of amphibole asbestos have been detected in the residential areas (residential sites) surrounding the industrial sites.

The proposed removal action will address immediate health threats identified in the residential areas during EPA's sampling in Northeast Minneapolis which occurred from March through



August 2000. EPA plans to conduct further sampling at the residential sites which surround the industrial site and in other areas that may have been impacted by the vermiculite processing operations at the Site. This subsequent sampling, analysis and evaluation may identify additional time-critical threats at other residential sites.

This site is not on the National Priorities List (NPL).

## **II. SITE CONDITIONS AND BACKGROUND**

CERCLIS ID # MNN 000 508 056

### **A. Site Description and Background**

The industrial sites are located at 1720 Madison Street N.E. and 1815 Jefferson Street N.E., Minneapolis, Hennepin County, Minnesota, and are bordered on the east by Burlington Northern Santa Fe railroad tracks, on the north by commercial buildings and west by residential properties and a city maintenance facility, and on the south by a commercial building.

The industrial sites consist of two parcels of land, one currently owned by Madison Complex, Inc. and the other currently owned by Electramatic, Inc. The site is occupied by a three-story brick office building, a brick warehouse structure, two four-story silos, and the Electramatic building to the north. The remaining portions of the industrial sites are parking lots and an abandoned section of 18<sup>th</sup> Street that divides the two parcels of land. The abandoned section of 18<sup>th</sup> Street is now owned by Electramatic and Madison Complex.

Western Mineral Products Company, a Minnesota company, operated at 1720 Madison Street N.E. as an independent company from 1946 to 1966. During part of this time it was a licensee of the Zonolite Company, a Montana Company. W.R. Grace acquired the Zonolite Company through a merger on April 16, 1963. The property at 1720 Madison was sold by W.R. Grace to Madison Complex, Inc. on October 24, 1989 by deed dated September 29, 1989. Allegedly, in 1990, W.R. Grace removed all materials that were stored in the two silos. The property at 1720 Madison is currently leased to Panel Specialties, Inc.(PSI), which manufactures prison furniture and security equipment on the property.

The Western Mineral Products Site at 1720 Madison Street N.E. processed vermiculite

ore that was shipped from the mine in Libby, Montana. The vermiculite ore body in Libby, Montana also contained amphibole asbestos fibers of the tremolite-actinolite-richterite-winchite solid solution series (herein referred to as amphibole asbestos) (Bureau of Mines Monograph, 1928). Unlike the commercially exploited chrysotile asbestos, the tremolite-actinolite material has never been used commercially on a wide scale, and for most of the mine's operating life was considered a contaminant. The commercially exploited vermiculite was used in a variety of insulation products and construction materials, as a carrier for fertilizer and other agricultural chemicals, and as a soil conditioner.

At the mine in Libby, Montana, the vermiculite ore was strip mined using conventional equipment and then processed in an on-site dry mill to remove waste rock and overburden. Once beneficiated, the processed ore was trucked to a screening plant, which separated the milled ore into five size ranges for use in various products. From there, the material was shipped across the country, predominantly by rail, for either direct inclusion in products, or for expansion (also known as exfoliation) prior to use in products.

The Western Mineral Products site in Minneapolis, Minnesota received Libby ore by rail. Expansion of the raw ore occurred inside the building at 1720 Madison Street. Expansion was accomplished by heating the ore, usually in a dry kiln, to approximately 2000 °F, which boiled the water trapped in the crystalline matrix of the vermiculite, thus expanding the material by a factor of 10 to 15 fold. The waste product from the expansion process contained high concentrations of amphibole asbestos. This waste product, also known as "Stoner Rock", was placed outside the building in a pile and was labeled as "Free Crushed Rock". The residents in the neighborhood were encouraged to take the waste material to use as fill on their properties. Residents hauled the "Free Crushed Rock" to their homes in their pickup trucks and cars. Allegedly the asbestos contaminated material was placed in yards, gardens, sandboxes, and barbeque grills. This practice may have occurred for more than 40 years.

## **B. Removal Site Assessment**

Between February and August 2000, the U.S. EPA Emergency Response Branch conducted site assessment activities to determine the potential health threat posed by amphibole asbestos-containing wastes which were produced at the former Western Mineral Products/W.R.Grace facility at 1720 Madison and deposited outside the plant and on residential properties in the surrounding neighborhood.

As part of a national evaluation of facilities that received vermiculite ore from the Libby,

Montana mine, the U.S. Environmental Protection Agency (EPA) Region 5 Emergency Response Branch conducted an initial site visit on February 2, 2000. The initial investigation consisted of a brief inspection and sampling of the former processing building and property, and interviews with State and local officials and some members businesses operating in the area.

During the investigation EPA observed exfoliated vermiculite insulation inside the building in a ceiling area on the first floor. Also, there was visible vermiculite in the surface soils around the building. Samples were collected from these areas and were analyzed using polarized light microscopy (PLM) and transmission electron microscopy (TEM). These samples indicated trace amounts of asbestos at concentrations less than 1% by visual estimate. On April 13, 2000, U.S. EPA returned to the site to perform additional of the surface soil and indoor insulation. While the indoor samples did not detect any asbestos, the three soil samples indicated levels between 2 % and 20 % asbestos. This finding triggered additional investigatory work and also a public meeting at the nearby armory in Northeast Minneapolis on April 13, 2000. At public meeting the local residents and the news media were updated on the national and local investigation of the vermiculite sites associated with the Libby, Montana mine. At the public meeting many residents expressed their concern with the adverse health effects associated with the Western Mineral Products site. Many of the former workers from the Site have contracted asbestosis or mesothelioma, both asbestos-related diseases.

These findings led EPA to initiate a residential property investigation with the following goals:





1. Visually identify asbestos contamination in alleys and yards;
2. Sample and analyze residential areas for asbestos;
3. Conduct door-to-door community outreach to determine the extent of contamination in the residential areas around the site.

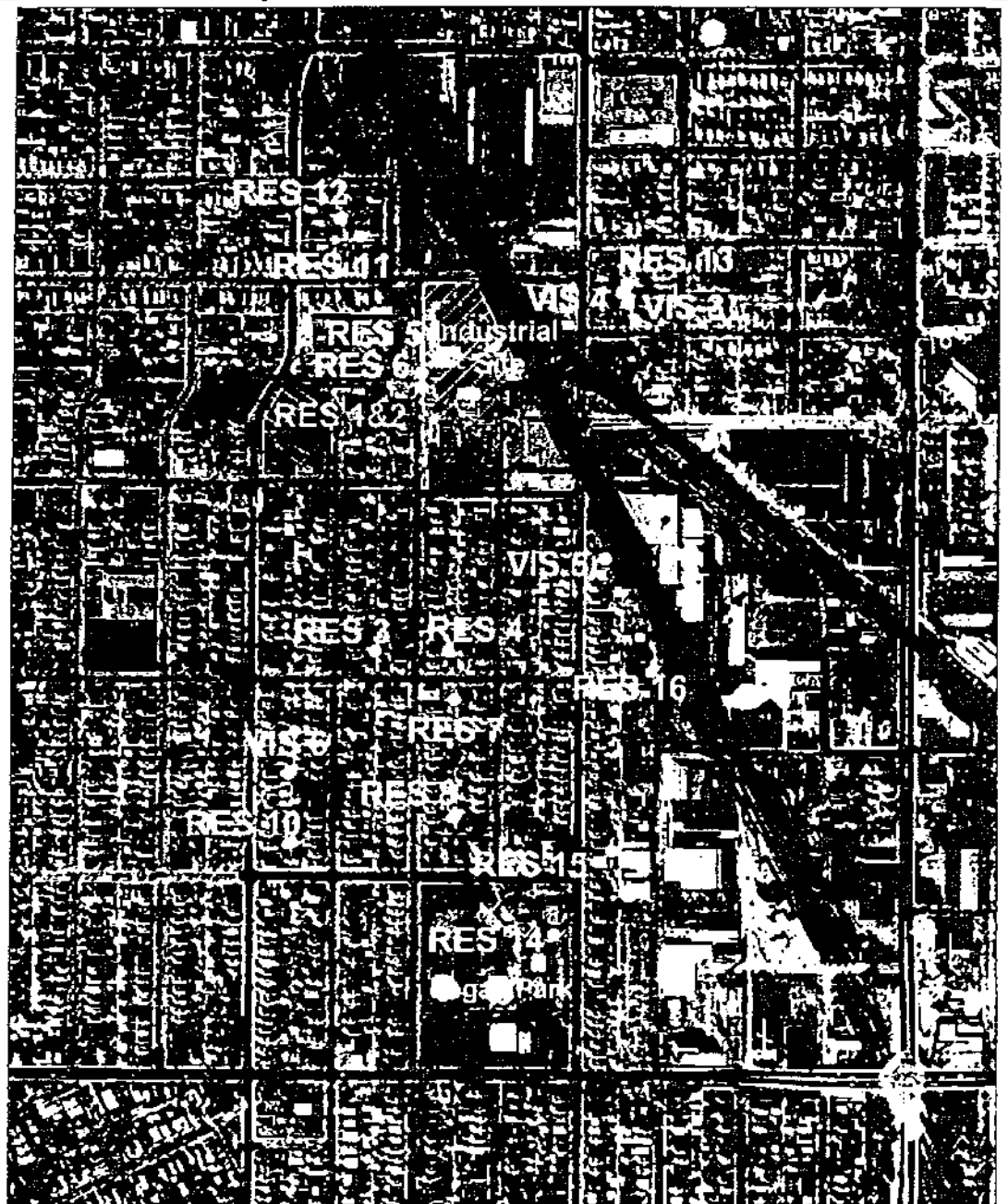
In June and July 2000, the EPA collected soil samples from alleys in the residential areas as part of the residential investigation and extent of contamination study (See Figure 1). Visible amphibole asbestos was observed and confirmed through laboratory analysis in the alleys and adjacent yards. Concentrations of asbestos as high as 95% were confirmed in samples taken from the concrete surface of the alleys. Because the Stoner Rock waste material was made readily available to the general public, EPA expects that other contaminated residences will be identified.

It has been the experience of EPA Region 8 that laboratories that were contracted to perform this analysis reported some difficulty in reading the samples due to the matrix and

# Western Mineral Site Vicinity of 1720 Madison Street NE Minneapolis, Minnesota

**Legend**

-  Grab Samples  
August 1-2, 2000
-  Grab Samples  
June 20-22, 2000
-  Visually Inspected  
August 1-2, 2000
-  Industrial Site



Preliminary Map  
Coordinate System  
UTM Zone 15, NAD 83

Sample Locations for August 1-2, 2000  
supported by GPS Locational Data

the long thin nature of the amphibole asbestos. As a result labs indicated that they were likely under reporting asbestos concentrations.

Asbestos is a hazardous substance as defined by 40 CFR Section 302.4 of the National Contingency Plan (NCP). Asbestos is of potential concern because chronic inhalation exposure to excessive levels of asbestos fibers suspended in air can result in lung disease such as asbestosis, mesothelioma, and lung cancer. Subacute exposures as short as a few days have been shown to cause mesothelioma. Exposures via ingestion and dermal contact are considered to be of lesser concern. Characteristics of amphibole asbestos that are of concern are in the range of greater than 5 microns in length and have an aspect ratio of greater than 5 to 1.

### **C. Community characteristics**

The Environmental Justice (EJ) Analysis indicated that the site is located in census tract 0025, block group 1, with a population of 376. To meet the EJ concern criteria, the area within 1-mile of the site must have a population that is twice the state low income percentage and/or twice the state minority percentage. For this site, the area must be at least 54% low-income and/or at least 12% minority. At this site, the low-income percentage is 55.1%, and the minority percentage is 19.7%. Therefore this site does meet the region's EJ criteria based on demographics as identified in "Region 5 Interim Guidelines for Identifying and Addressing a Potential EJ Case, June 1998".

## **III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES**

### **A. Threats to Public Health or Welfare**

The threat of exposure to residents exists through direct contact and subsequent inhalation of amphibole asbestos which is currently in the alley's and yards of residential properties around the Site. The conditions at the Site present an imminent and substantial threat to human health and the environment and meet the criteria for initiating a Removal Action under Section 300.415(b)(2) of the NCP. The following factors from §300.415(b)(2) of the NCP form the basis for EPA's determination of the threat presented, and the appropriate action to be taken:

- (i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances: The large concentrations of asbestos found in the residential alley's and in surface soils in yards indicate that the human exposure

pathway exists. In evaluating the threat posed by this exposure there are several factors to consider. The first is a historic review of the effects that have been documented by exposures to similar conditions. The second is construction of an appropriate conceptual risk model to quantitatively estimate current risks.

Given the occurrences of documented cases of asbestos related disease and death associated with handling of the ore, vermiculite product, and wastes from the Western Mineral site, it is reasonable to conclude that this known exposure pathway is an imminent and substantial threat to public health and welfare. In support of this conclusion the OSC sought and received concurrent opinions from the EPA Regional Toxicologist (see Attachment 3).

(iv) High levels of hazardous substances in soils largely at or near the surface, that may migrate; Vermiculite and pieces of amphibole asbestos are visible at the surface at both the industrial site and residential sites. Surface soils at both the industrial and residential sites contain high measured asbestos levels scattered widely over the surface of the properties. There are several pathways by which these asbestos fibers can become entrained in air leading to inhalation exposures. Contaminated soils can easily be tracked into buildings or off the contaminated properties by truck, automobile, bicycle, and/or pedestrian traffic; and then through normal activities, such as vacuuming or other air disturbance, become respirable dust. Wind, particularly in dry summer months, can lead to the migration of fine asbestos fibers from contaminated surface soils. Rainfall and snow melt would also tend to wash the fibers off of the residential yards onto the adjacent alley's and to the nearby streets and sewers where they could also become airborne.

There is documentation that in the past, area residents would remove bulk waste vermiculite that had been abandoned by Grace at the industrial site to use as fill around their homes. This has resulted in the contamination of yards, driveways, and gardens with amphibole asbestos in the area around the site and possibly on residential sites in the suburbs surrounding Minneapolis. Residents and newspaper reports indicate that from the 1940's through the 1980's children in the neighborhood played in the large pile of waste vermiculite that was labeled "Free Crushed Rock" by W.R. Grace.

Currently EPA has not established, under any of its regulatory programs, an asbestos level in soil below which an exposure does not pose a risk. The 1% cut-off level for regulation under the Toxic Substances Control Act abatement program was established on the basis of analytical capability at the time, and was not established based on the level of risk represented. To the contrary, at Superfund

sites in California EPA Region IX found in certain settings that concentrations of asbestos less than 1% posed unacceptable inhalation risks when subject to disturbance by traffic (EPA, 1994).

(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released; The warmer temperatures and dry weather typical in the summer and fall months in Minneapolis will contribute to the migration of asbestos containing soils. As soils dry out they are more likely to be transported by wind, causing the asbestos to become airborne and available for inhalation. In the spring time snow melt, rainfall, or other forms of run-off inducing events will tend to spread the contamination further from the yards to the alley's to the streets.

(vii) The (lack of) availability of other appropriate federal or state mechanisms to respond to the release; No other Local, State, or Federal agency is in the position or currently has the resources to independently implement an effective response action to address the on-going threats presented at the residential sites. EPA will conduct its actions in cooperation with State and local authorities. The Minnesota Pollution Control Agency (MPCA) is the lead oversight agency for the cleanup of the industrial site under their voluntary cleanup program.

#### **B. Threats to the Environment**

The Site investigation has not proceeded far enough to know if the asbestos contamination is a threat to animals, water, and other parts of the environment. Asbestos is primarily a threat to human health.

### **IV. ENDANGERMENT DETERMINATION**

Asbestos is a generic term for a group of six naturally-occurring fibrous silicate minerals. The predominant fibrous nature of minerals found at the Western Mineral Products Site are of the tremolite-actinolite solid solution series (referred to in this Action Memo as amphibole asbestos). Asbestos can cause asbestosis and is a recognized human carcinogen, causing lung cancer and mesothelioma, a lethal neoplasm of the lining of the chest and abdominal cavities. All of these asbestos related diseases have been found, to an unprecedented extent among former plant workers, their families, and to nearby residents with no known occupational or family connection to the vermiculite processing operations in Minneapolis. Cancer of the larynx and esophageal lining has also been associated with exposure to asbestos. Commercial forms of asbestos have been found to be carcinogenic in experimental animals.



Actual or threatened releases of asbestos from this Site, if not addressed by implementing the response action selected in this Action Memorandum, present an imminent and substantial endangerment to public health, welfare, and the environment.

## **V. PROPOSED ACTIONS AND ESTIMATED COSTS**

### **A. Proposed Actions**

To mitigate the threat to the public health and welfare or the environment posed by the asbestos present on the residential properties, the proposed removal actions are outlined below. The removal will involve the following:

- a. Develop and implement a site health and safety plan;
- b. Determine the horizontal extent of asbestos contamination in the contaminated residential sites and identify areas to be remediated;
- c. Excavate and remove asbestos contaminated soils to a maximum depth of 18 inches in the yards and alley's;
- d. Dispose of contaminated soils at an EPA-approved off-site disposal facility;
- e. Remove and dispose of asbestos from the surface of the paved alley's and driveways;
- f. Perform personal air sampling and ambient air sampling during remediation activities;
- g. Implement engineering measures to control dust during the cleanup;
- h. Install a synthetic liner at the bottom of the excavated area prior to backfill;
- i. Analyze bulk asbestos samples using standard Polarized Light Microscopy (PLM) methods. Supplement PLM analysis with Transmission Electron Microscopy (TEM) for samples with lower concentrations of asbestos to assess whether contamination is present and whether sufficient excavation has occurred;
- j. Backfill excavated areas with clean soil and restore property to original pre-removal condition;

It is estimated that each residential property will take approximately an average of 1.5 days of on-site work time to remediate. This project is estimated to take 40 days to complete assuming that 30 residential properties require remediation.

For the purposes of this initial removal action, cleanups will be initiated at properties with asbestos contamination levels of 1% or greater. Surface soils with detectable levels of contamination will be removed. The excavation depth will be approximately 18 inches.

In accordance with Section 300.415(l), EPA will pursue appropriate arrangements for

post-removal site controls at the disposal site to ensure the long-term integrity of the removal. EPA has not yet made a decision regarding NPL listing for the Site. The proposed removal actions should compliment and contribute to the overall success of any remedial actions in the future.

As this cleanup is being conducted as a Time-Critical Removal Action, all Federal and State ARARs may not have been identified at this time. In accordance with the NCP, all ARARs for the Site will be attained to the extent practicable, given the scope of the project and the urgency of the situation as they are identified.

Many of the ARARS identified for these Removal Actions come from the Clean Air Act National Emission Standards for Hazardous Pollutants (NESHAPS) for asbestos. These regulations were designed specifically for renovation and demolition of buildings with asbestos containing material (ACM) such as floor tile, ceiling tile and pipe wrapping. The regulations were not designed for piles of unexpanded vermiculite, contaminated soils, or heavily contaminated dust. As such, it is anticipated that it may not be practicable to achieve all ARARS during this Removal Action.

#### **B. Estimated Costs**

The following cost estimates include costs associated with the residential removal actions for purposes of creating a total project ceiling. These costs are being estimated anticipating that the project will need to be performed as a fund lead action. The costs do not include any past or future investigation costs on the Site. Costs are projected as follows:

##### **EXTRAMURAL COSTS**

Cleanup Contractor Costs	\$ 645,000
Contingency (15%)	\$ 96,750
Subtotal	\$ 741,750
START	\$ 30,250
Extramural Subtotal	\$ 772,000
Extramural Contingency (10%)	\$ 77,200
TOTAL, EXTRAMURAL COSTS	\$ 849,200

#### **INTRAMURAL COSTS**

U.S. EPA Direct Costs \$30 x (500 Regional Hours + 50 H.Q. hours)	\$ 16,500
U.S. EPA Indirect Costs \$65 x 500 Regional Hours	\$ 32,500
TOTAL INTRAMURAL COSTS	\$ 49,000

**TOTAL PROJECT CEILING** \$ 898,200

A detailed cleanup contractor cost breakdown is available as Attachment 1.

#### **VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN**

Delayed action will increase public health risks to the local population/environment posed by asbestos fibers in the residential alleys and yards.

#### **VII. OUTSTANDING POLICY ISSUES**

Asbestos removals have been completed in Region 5, and around the country at numerous removal sites which were initiated under Section 300.415 of the NCP and in compliance with NESHAPS regulation under 40 CFR Section 61.150. This removal does not set a precedent or constitute a nationally significant issue. Because of the potentially broad impact of the vermiculite ore with high levels of amphibole asbestos mined from the Libby, Montana deposits, EPA Region 5 is coordinating with EPA Headquarters and other regions to assure a consistent approach to vermiculite issues.


#### **VIII. ENFORCEMENT**

For administrative purposes, information concerning the enforcement strategy for this Site is contained in the attached Enforcement Confidential Addendum.

## IX. RECOMMENDATION

This decision document represents the selected initial Removal Action for the residential portion of the Western Mineral Products Site, located in Minneapolis, Hennepin County, Minnesota, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. This decision is based on the Administrative Record for the Site. Conditions at the Site meet the NCP §300.415(b)(2) criteria for a Removal Action, and your approval is recommended. The total project ceiling, if approved, will be \$ 898,200. Of this, \$ 818,950 may be used for cleanup contractor costs. You may indicate your decision by signing below.

APPROVE: \_\_\_\_\_

*for*   
William E. Muno, Director  
Superfund Division

Date: \_\_\_\_\_

7/21/00

DISAPPROVE: \_\_\_\_\_

William E. Muno, Director  
Superfund Division

Date: \_\_\_\_\_

### Attachments:

- Figure 1 - Site and Residential Sample Location Map
- Attachment 1 - Cleanup Contractor Costs
- Attachment 2 - Administrative Record Index
- Attachment 3 - EPA Toxicologist's Memorandum
- Attachment 4 - Confidential Enforcement Attachment
- Attachment 5 - Environmental Justice Analysis



## Vermiculite Processing Operations in Northeast Minneapolis

Update from the Minnesota Department of Health

September 2000

### Vermiculite, Zonolite, and "Stoner Rock"

Vermiculite is a naturally-occurring mineral used in insulation, construction, and gardening products. Processed vermiculite (sometimes sold under the name "Zonolite") has been primarily made from ore mined in Libby, Montana by the Zonolite/W.R.Grace company. In fact, from 1924 to 1990, most of the world's supply of raw vermiculite ore came from Libby. This ore is now known to contain tremolite, a form of asbestos fiber.

Ore from the Libby mine was shipped to many processing plants around the country, including several plants in Minnesota. From about 1938 to 1988, ore from the Libby mine was processed at the Western Mineral Products plant located at 1720 Madison St. NE in Minneapolis. Beginning in the 1960s, this plant became part of the W.R. Grace company. At this plant, raw vermiculite was heated until the moisture trapped in the ore caused it to pop, in a manner similar to that of popcorn. After going through this "exfoliation" process, the vermiculite had a porous structure, making it suitable for insulation.

Most testing to date has shown that the Zonolite product used for insulation has less than 1 percent asbestos. Building materials with more than 1 percent asbestos are regulated due to health concerns.

In addition to the vermiculite product, the exfoliation left waste rock (known as "stoner rock" and "crush rock") that also contains asbestos fibers. Recent analyses of some samples at the former Western Mineral Products/Grace plant have found up to 20 percent asbestos in this waste rock. The sampling results of the "stoner rock" indicate that this waste material may contain a concentration of asbestos fibers greater than the vermiculite product "Zonolite."

### Health risks

It has been known for many years that workers exposed to asbestos have suffered from asbestos-related diseases. In addition to lung cancer, asbestos exposure can also cause a rare type of cancer known as mesothelioma, which affects the lining around the lungs and abdomen.

It can also cause a type of permanent lung damage known as asbestosis, which causes shortness of breath and increases the risk of serious lung infections.

More recently, serious concerns have been raised about a high prevalence of asbestos-related disease in Libby, Montana—among people who worked in the vermiculite mines, their families, and other members of the community. Currently, the federal Agency for Toxic Substances and Disease Registry (ATSDR) and the U.S. Environmental Protection Agency (EPA) are conducting investigations to determine the extent of the health problems in this community.

The investigations in Libby have lead to further exploration of possible asbestos exposure in other locations around the country. Vermiculite ore has been shipped to and processed at many places, including the former Western Minerals Products site in Minneapolis.

Staff from the Minnesota Department of Health (MDH), Minnesota Pollution Control Agency (MPCA), and U.S. EPA have received reports of asbestos-related disease among former workers at the northeast Minneapolis facilities, as well as residents of the surrounding community.

We have also learned that the waste rock material was offered to area residents for free and was used as filler, in driveways, and for other purposes on their own property. Some people from the community played on piles of the waste rock many years ago when they were children.



Division of Environmental Health  
121 E. Seventh Place, Suite 220  
St. Paul, Minnesota 55101  
(651) 215-0700  
[www.health.state.mn.us](http://www.health.state.mn.us)



It is important to note that the health risks associated with exposure to asbestos in the vermiculite can vary, depending on the kind of exposure a person had.

Those at highest risk include:

- people who worked in the processing plant

Those at a lower risk include:

- people who lived with those workers,
- children who played on the waste rock piles

The risk may be lowest for:

- people who moved or used waste rock,
- people who simply live in the neighborhood but had no direct contact with the materials.

The Libby investigation should provide us with a clearer picture of the health risks.

**Further investigation and clean-up planned**  
MDH, MPCA, and EPA are currently working on a multi-phase investigation. We want to more clearly define the extent of asbestos exposure from the Western Mineral Products site—both to workers and for people in the community.

An investigation of the waste material on the site, and in any off-site locations, will be conducted. Visible material in yards, driveways, and alleys will be removed. An assessment of asbestos in soil around the neighborhood will also be done.

Investigators plan to ask neighbors living near the site to complete a questionnaire. This will help to identify where the waste rock material may have been transported and used off the site.

Investigation and clean-up of visible areas of contamination will begin this fall and continue in the spring, when the ground is bare.

### **Preventing exposure**

It is important that residents are informed of potential health risks associated with any waste rock that can still be found in the area. On the former Western Mineral Products/Grace site, the material has been covered with plastic and access to the site is restricted.

To prevent exposure to residents during removal activities, access to the area will be restricted. Clean-up workers will be protected from the dust with special protective clothing and respirators.

Residents who know they have this material on their property should cover the material and restrict access to it. If you have any of this material, you can call and report it to T. Stuart Hill of the EPA at (312) 886-0689. Homeowners should not attempt to remove the material themselves, since any disturbance of the asbestos-containing rock may release hazardous levels of asbestos into the air.

In place, Zonolite and other vermiculite insulation products do not present as much health risk to residents as the waste rock. There is usually no need to remove Zonolite or vermiculite insulation from homes. Homeowners who are concerned about the asbestos content of their insulation may want to have it tested by an accredited laboratory. To find one, you can contact the Minnesota Department of Health's Asbestos Unit at 651/215-0900.

For the safety of both residents and visitors in your home, asbestos-containing materials should be removed by a specially licensed contractor.

Residents concerned about health problems associated with asbestos exposure should consult their physician. A chest x-ray and lung function test can detect asbestos-related diseases. These diseases generally are not diagnosed until 20-30 years after exposure has occurred.

### **Vermiculite products still on the market**

Although vermiculite no longer comes from the Libby mine, the EPA and the Consumer Product Safety Commission are investigating whether current vermiculite garden products contain harmful levels of asbestos. Testing so far indicates that most products contain little—if any—asbestos, and that this potential exposure poses a minimal health risk to consumers.

The EPA notes that these risks can be further reduced by:

- using vermiculite outdoors or in well-ventilated areas



- keeping vermiculite damp while using it to reduce the amount of dust created
- avoiding dust from vermiculite being brought into the home on clothing
- using pre-mixed potting soil, which usually contains more moisture and less vermiculite
- using other soil additives, such as peat, sawdust, perlite, or bark.

#### **For more information**

If you would like further information, address health concerns to Lisa Pogoff of the Minnesota Department of Health at 651/215-0916 or at [lisa.pogoff@health.state.mn.us](mailto:lisa.pogoff@health.state.mn.us). Questions or concerns about the clean-up can be addressed to Jeff Connell of the MPCA at 651/296-7271 or at [jeff.connell@state.mn.us](mailto:jeff.connell@state.mn.us). Additional sources of information about vermiculite and asbestos include:

U.S. EPA website: <http://www.epa.gov/>

EPA asbestos page: <http://www.epa.gov/asbestos>

EPA Superfund hotline:

<http://www.epa.gov/epaoswer/hotline>

Consumer Product Safety Commission:

<http://www.cpsc.gov/>

<http://www.cpsc.gov/cpscpub/pubs/5080.html>

EPA Superfund hotline: 1/800-424-9346,

TDD: 1/800-553-7672

Agency for Toxic Substances and Disease

Registry info line: 1/888-42-ATSDR





## Office Memorandum

DATE : June 12, 2001

TO : Jim Kelly  
Minnesota Department of Health, Environmental HealthFROM : Gregory C. Pratt, Ph.D. *gc pratt*  
Research Scientist  
Environmental Outcomes Division

PHONE : 612.296.7664

SUBJECT : Modeled Concentrations and Deposition of Tremolite Near the Western Mineral Products/W.R. Grace Facility**Introduction**

This memo documents an air dispersion modeling study done to estimate airborne concentrations and deposition of tremolite fibers around the Western Mineral Products/W.R. Grace, Inc. vermiculite processing facility in Northeast Minneapolis. The study consisted of two parts: 1) estimation of emissions; and 2) use of an air dispersion model to estimate airborne concentrations and fiber deposition onto surfaces in the vicinity of the plant. Two time periods were considered, the period 1936 to 1972 (from initiation of operations until the baghouse filtration system was installed) and the period 1972 to 1989 (from baghouse installation until the facility ceased operations). The following sections discuss emissions estimation, modeling procedures, and modeling results.

**Estimation of Emissions**

Two fifty foot stacks served the expanding furnaces and a third stack served the monokote mixer. In addition to these three point sources, four sources of fugitive emissions were identified: 1) rail unloading of raw material; 2) rail loading of finished product; 3) truck loading of finished product (including truck traffic on unpaved surfaces containing tremolite fibers); and 4) handling and wind erosion of the waste pile. Figures 1 and 2 are photographs of the facility from opposite angles taken in February, 2001. Figure 3 is a schematic diagram showing the locations of the buildings and sources as represented in the model.

Attachment I is a spreadsheet showing the stack parameters and emissions calculations for the stacks for each of the two time periods. Two options were possible for estimating stack emissions. The first option was to use the 1977 and 1985 reported stack emissions. The second option was to use the estimated baghouse loading and the estimated baghouse efficiency. The 1977 emissions inventory report shows emissions of 0.12 tons per year of (tpy) of total suspended particles (TSP) for stacks one and two and 0.10 tpy of TSP for stack three. These values were said to be based on stack test data although the reports do not specify a test date nor whether this facility or some similar facility was tested. The 1985 emissions inventory report shows emissions

of 0.06 tpy of particles less than ten micrometers in diameter ( $PM_{10}$ ) for stacks one and two and 0.02 tpy  $PM_{10}$  for stack three. These values were said to be based on stack tests of similar equipment. No documentation of the stack tests was available.

Several documents contained information about the configuration, operation, and efficiency of the baghouse, including the 1977 and 1985 emissions inventory reports, the 1972 plans and specifications for the baghouse submitted by the company to the Minnesota Pollution Control Agency (MPCA), the 1975 MPCA Operating Permit, a report to the U.S. Environmental Protection Agency from the company (date obscured) on emissions of hazardous air pollutants, and a 1986 internal company document entitled *Process Description and Waste Profile*. The permit-allowable particle emissions were considerably larger than the amounts in the emission inventory reports. Based on the baghouse configuration, operation, and efficiency as outlined in the aforementioned documents, I judged the amount of particle emissions to be larger than the amounts reported in the emissions inventory reports for 1977 and 1985. For that reason, the second option for estimating stack emissions was used for stacks one and two, i.e., estimated baghouse loading and the estimated baghouse efficiency. The only emissions information available for stack three were the emissions inventory reports, so those data were used for this stack.

The baghouse loading was given as between 15 and 20 pounds per hour (lb/hr), and the tremolite concentration of the baghouse inputs was given as 1-3%. These values were used to place upper and lower bounds on the stack emissions (see Attachment 1). The upper and lower bound values differed by almost one order of magnitude. The average of the upper and lower bound values was used as the modeled emission rate for each of the two timeframes. The documents mentioned in the preceding paragraph give conflicting information on the hours per day of operation of the facility. Some suggest that the facility operated two shifts per day, while the emissions inventory reports mention 24-hour per day operation. For this simulation the furnaces were assumed to be operating at full production for 16 hours per day (6:00 am to 10:00 pm). This assumption is warranted since, even if the facility operated longer hours on some days, it is unlikely that full production was maintained for more than the equivalent of 16 hours per day over an extended period of time. The model-predicted concentrations are not dramatically changed using this assumption.

Attachment 2 is a spreadsheet showing the methods and equations for calculating fugitive emissions. The rail unloading emissions were taken from the U.S. EPA emission factor document for vermiculite processing. No emission factors were available for rail or truck loading, so the emissions from these sources were taken as one-half of the rail unloading emissions. This estimate was a judgment based on the fact that the loaded product was packaged, thus preventing some emissions as compared to the unloading process. The wind erosion and materials handling emissions from the waste pile were taken from U.S. EPA emissions factors documents for industrial wind erosion and aggregate handling and storage piles, respectively. Emissions from traffic in the unpaved truck loading area were developed from U.S. EPA emissions factors for traffic on unpaved roads. All of the fugitive emissions sources were characterized as area sources. The lateral dimensions of each source can be seen in Figure 3. The waste pile was given an initial

vertical dimension of two meters, while the other fugitive sources were given an initial vertical dimension of one meter.

The fugitive emissions estimates were based on total annual production. Apportioning the emissions to specific times of the day was not feasible since loading and unloading could have occurred at any time. Similarly, wind erosion from the waste pile was not limited to specific hours of the day. An often-used simplification was assumed in which the fugitive emissions were apportioned evenly throughout the hours of the year. This assumption does not significantly affect the model-predicted long-term concentrations; however, it may lead to some underestimation of the maximum short-term (e.g., 1-hour average) concentrations.

### **Modeling Procedures**

The ISC-Prime model was chosen for this analysis. The ISC model is the currently recommended model for industrial sources in the U.S. EPA Guideline on Air Quality Modeling (40 CFR 51, Appendix W). ISC-Prime represents a new version of the ISC model that has been proposed for adoption as a Guideline model. This new version contains an improved algorithm for calculating building-wake effects, the Prime algorithm. Since the Western Mineral Products/W.R. Grace, Inc. facility stacks are subject to building wake effects, the use of the best available model for considering such effects was considered important.

The model was run using the regulatory default model options. Five years of meteorological data (1986-1990) from the Minneapolis-St. Paul International Airport (surface data) and from St. Cloud (upper air data) were used in the analysis. Both air concentrations and total (wet plus dry) deposition were calculated. Plume depletion was not used. A polar-coordinate grid system of receptors was used with receptors located at distances of 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, and 1500 meters at every ten degrees of the compass. In addition, a group of 656 discrete Cartesian receptors was specified, corresponding to all street addresses located within 500 meters of the facility. These discrete receptors were included so that concentrations could be predicted at each of the individual homes and businesses within the 500-meter radius. Terrain elevations were included. Predictions were made of the maximum one-hour, 24-hour, and long-term average concentrations and the long-term deposition fluxes.

### **Modeling Results**

Figures 4-11 are maps of the area around the Western Mineral Products/W.R. Grace, Inc. facility showing isopleths of concentrations of airborne tremolite fibers in units of fibers per cubic centimeter of air (Figures 4-6 and 8-10) or deposition of tremolite fibers in units of fibers deposited per square meter of land area (Figures 7 and 11). Figures 4-7 pertain to the case after the baghouse filtration system was installed (i.e., after 1972), while Figures 8-11 pertain to the

Three things are immediately apparent from the maps. First, the pattern of concentrations and deposition around the facility is nearly uniform, i.e., the concentration isopleths form approximately circular patterns around the facility rather than being skewed in one direction or another. This pattern is not unusual for a facility of this type. Second, the concentration and deposition gradients are quite steep. Concentrations and deposition are highest in the immediate vicinity of the facility, but drop off rapidly with distance, in many cases decreasing by an order of magnitude within a few hundred meters. Third, the pre-baghouse and post-baghouse cases differ by approximately one order of magnitude.

Attachment 3 gives a listing of the concentrations and deposition predicted at all the addresses within 500 meters of the facility. Concentrations at other addresses can be determined by manually viewing the isopleth maps, but in addition, I will supply electronic versions of the plot files so that concentrations and deposition can be interpolated for any address of interest.

Table 1 lists the minimum and maximum model-predicted airborne concentrations of tremolite fibers for each of the cases (Pre-baghouse and Post-baghouse) and averaging times (one-hour, 24-hour, and long-term), as well as the long-term deposition of tremolite fibers. The maximum concentrations and deposition invariably occurred within a few meters of the facility, and the minimum concentrations occurred at the most distant receptors (i.e., 1500 meters from the facility).

Attachment 4 is a listing of the model output file for the Pre-baghouse (1936-1972) case, and attachment 5 is a listing of the model output file for the post-baghouse (1972-1989) case. These two attachments are over 100 pages in hard copy and will be supplied in electronic format only.

### **Sources of Error**

As with all such undertakings, there are several sources of error that affect the estimated concentrations and deposition. The predicted concentrations and deposition should be thought of as the best central estimate with error bounds on either side. Exact numerical propagation of each of the sources of error through the entire modeling process is beyond the scope of this analysis; however, I will attempt to give some insight into the types and magnitudes of the possible sources of error.

The model itself is a mathematical representation of atmosphere and does not perfectly simulate all the processes that affect pollutant dispersion. It is often stated (see U.S. EPA Modeling Guideline, 40 CFR 51, Appendix W) that the current generation of regulatory air dispersion models are capable of accuracy to within a factor of two, given accurate information on the source release characteristics and representative meteorological data. Model accuracy is also known to be better for long averaging times (e.g., annual average) than for short averaging times (e.g., one-hour average).

In the present study, the meteorological data can be considered to be reasonably reliable and representative. It was taken from a contiguous five-year period at the Minneapolis-St. Paul airport (surface data) and from St. Cloud (upper air data). The surface data site is within 15 kilometers of the facility, and there are no significant terrain features between the locations that would dramatically affect airflow patterns. The upper air data site, while approximately 100 km distant, was the nearest source of upper-air soundings available. Use of this type of off-site, National Weather Service meteorological data is routine for this type of modeling study, and while there are undoubtedly some errors introduced by using off-site meteorological data, these errors are likely to be minor when compared to errors in source characterization.

The Western Mineral Products/W.R. Grace facility in northeast Minneapolis has been out of operation for about 12 years. The buildings are still standing, but the stacks have been removed. Information about the operation of the stacks was taken from older documents whose reliability is at least somewhat uncertain. The stack physical dimensions are likely to be accurate, but the temperature, airflow, and tremolite fiber concentrations in the stack gases were likely to have varied over time for multiple reasons. In addition, the loading to the baghouse was only given to within specified limits (15-20 lb/h). The data currently available on the stack emission parameters represent estimates taken once (or a few times), usually for the purpose of fulfilling a regulatory requirement (e.g., permit application or emissions inventory report). Some of the estimates were likely based on measurements made at the facility, some estimates may have been based on similar equipment operated elsewhere, and other estimates may have been based upon the equipment vendor's specifications.

Another source of error is the tremolite concentration in the raw materials supplied to the facility. The concentration likely varied from shipment to shipment, but such data were not collected. There is information about the range in the amounts of tremolite fibers typically seen in the various materials (Stoner Rock – 2% to 10%, Baghouse Fines – 1% to 3%, Vermiculite Screenings - <0.5%), but not for the actual individual shipments made to the Minneapolis plant. The bottom line is that the total range of uncertainty in the stack emissions may be on the order of a factor of ten.

The largest source of error in the source characterization is undoubtedly that for the fugitive sources. Fugitive sources represented one percent of the total emissions in the Pre-baghouse case and nine percent of the total emissions in the post-baghouse case (Table 2). These emissions are quantified using information about the amounts of material handled (both raw materials and finished products), the amounts of tremolite fibers in the materials, the number of vehicles required to transport the products, and other factors. The emission factors were based on values developed for general industrial classifications and for generic process like wind-entrainment of dust and vehicle traffic on unpaved surfaces. The uncertainties in the fugitive source parameterizations cannot be accurately quantified.

Attachment 6 gives the comments made by the Minnesota Department of Health and my responses.

**Table 1. Minimum and maximum model-predicted airborne concentrations of tremolite fibers in the modeling domain for each of the cases (Pre-baghouse and Post-baghouse) and averaging times (one-hour, 24-hour, and long-term), as well as the long-term deposition of tremolite fibers**

Case/Averaging Time	Minimum concentration (fibers/cc) or deposition (fibers/m <sup>2</sup> )	Maximum concentration (fibers/cc) or deposition (fibers/m <sup>2</sup> )
<b>Post-Baghouse</b>		
One-hour average	0.00049	0.0426
24-hour average	0.00004	0.0101
1972-89 average	0.000001	0.0015
Deposition (1972-89)	46	31,612
<b>Pre-Baghouse</b>		
One-hour average	0.00677	0.2524
24-hour average	0.00049	0.1089
1936-72 average	0.00002	0.0148
Deposition (1936-72)	1049	838,211
Total Deposition (1936-89)	1096	869,824

**Table 2. Apportionment of emissions between stack and fugitive sources. Values are in tons per year (tpy) of tremolite fiber emissions.**

Case	Stack emissions (tpy)	Fugitive emissions (tpy)	Total emissions (tpy)	Percent Fugitive
Pre-baghouse	0.790	0.0116	0.802	1%
Post-baghouse	0.054	0.0052	0.059	9%

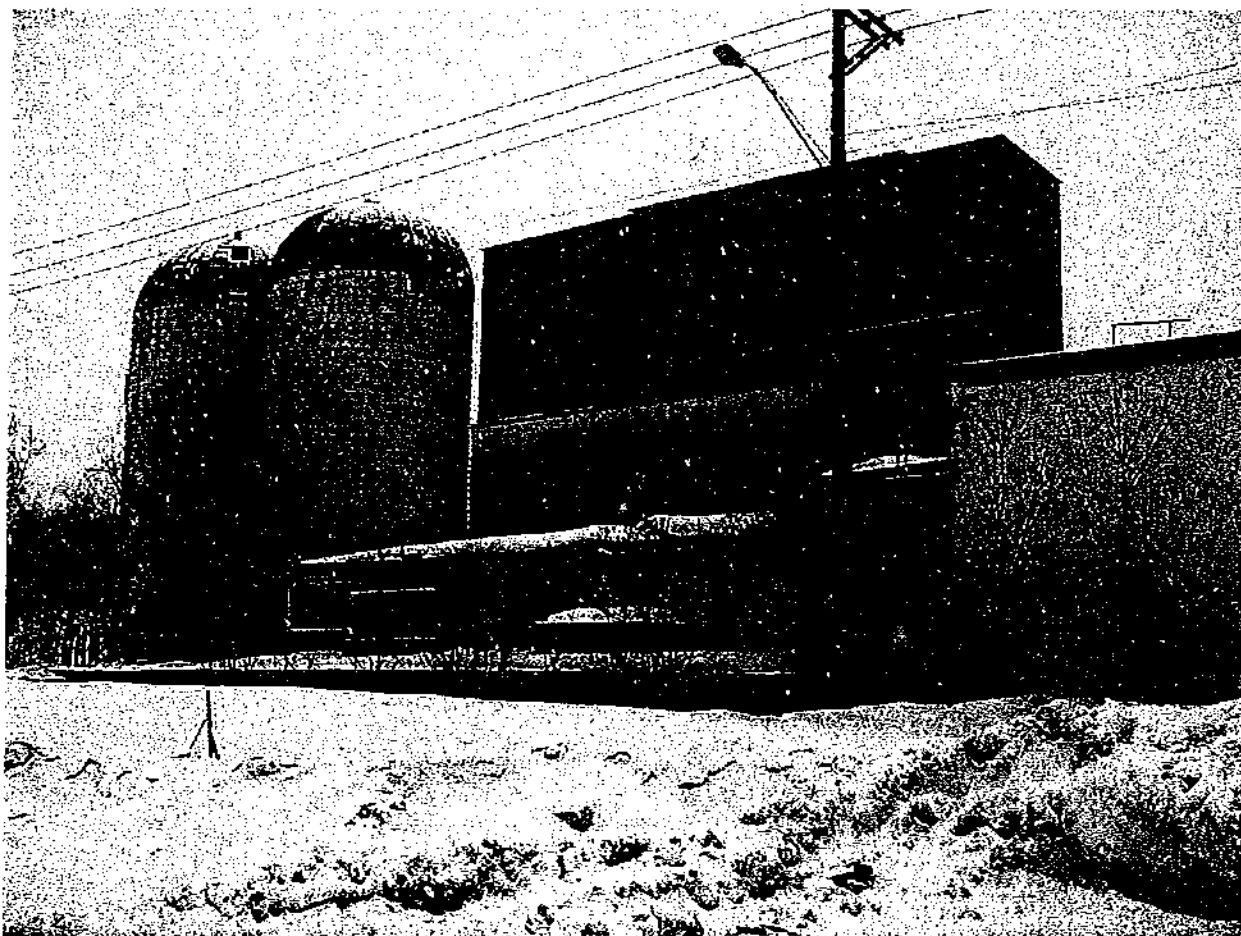


Figure 1. Photograph of the Western Mineral Products/W.R. Grace facility taken in February, 2001. This photo shows the north side of the four-story, sheet-metal building that housed the expanding furnace. To the left are raw material storage silos, and to the right is the cement-block building for product handling and shipping.



Figure 2. Photograph of the Western Mineral Products/W.R. Grace facility taken in February, 2001. This photo was taken from the southwest side of the facility. The four-story, sheet-metal building that housed the expanding furnace can be seen in the background. To the right is the brick building which housed operations and some shipping, and to the left is the cement-block building for product handling and shipping. The waste pile was located at the far left end of the cement-block building.



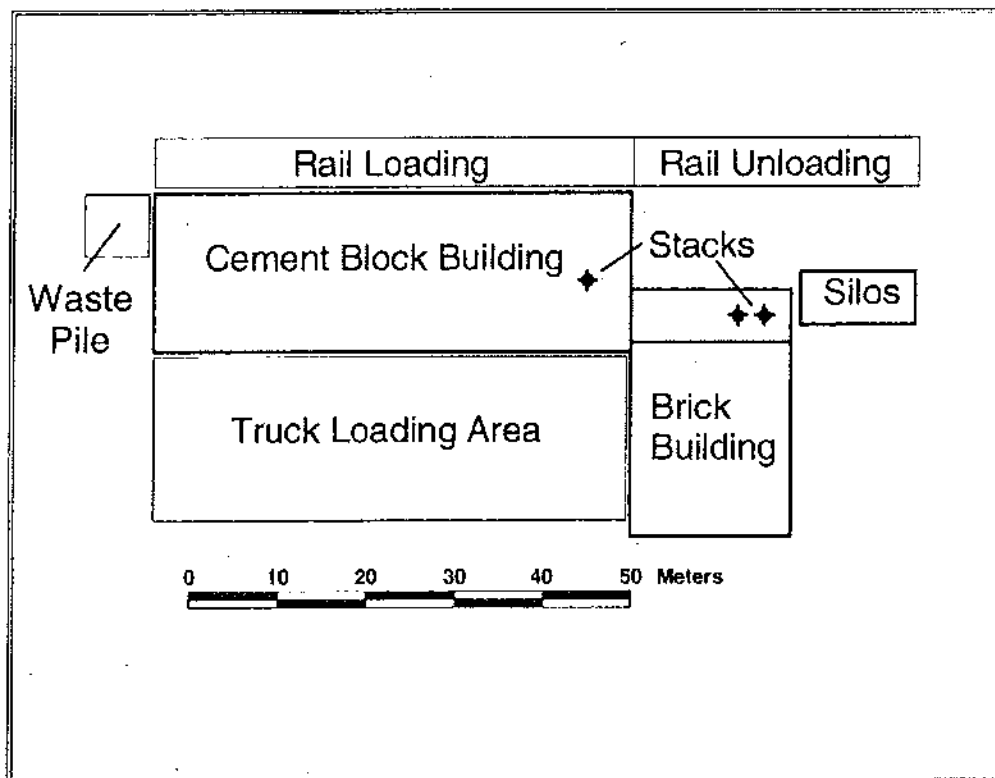


Figure 3. Schematic diagram of the Western Mineral Products/W.R. Grace, Inc. facility showing the locations of the buildings and the sources as represented in the air dispersion model. The three cross marks are the three stacks, two of which were located on the sheet-metal building and the third (monokote mixer stack) was located on the cement block building. The sheet-metal building, the only building not labeled in the diagram, is located directly north of the brick building.

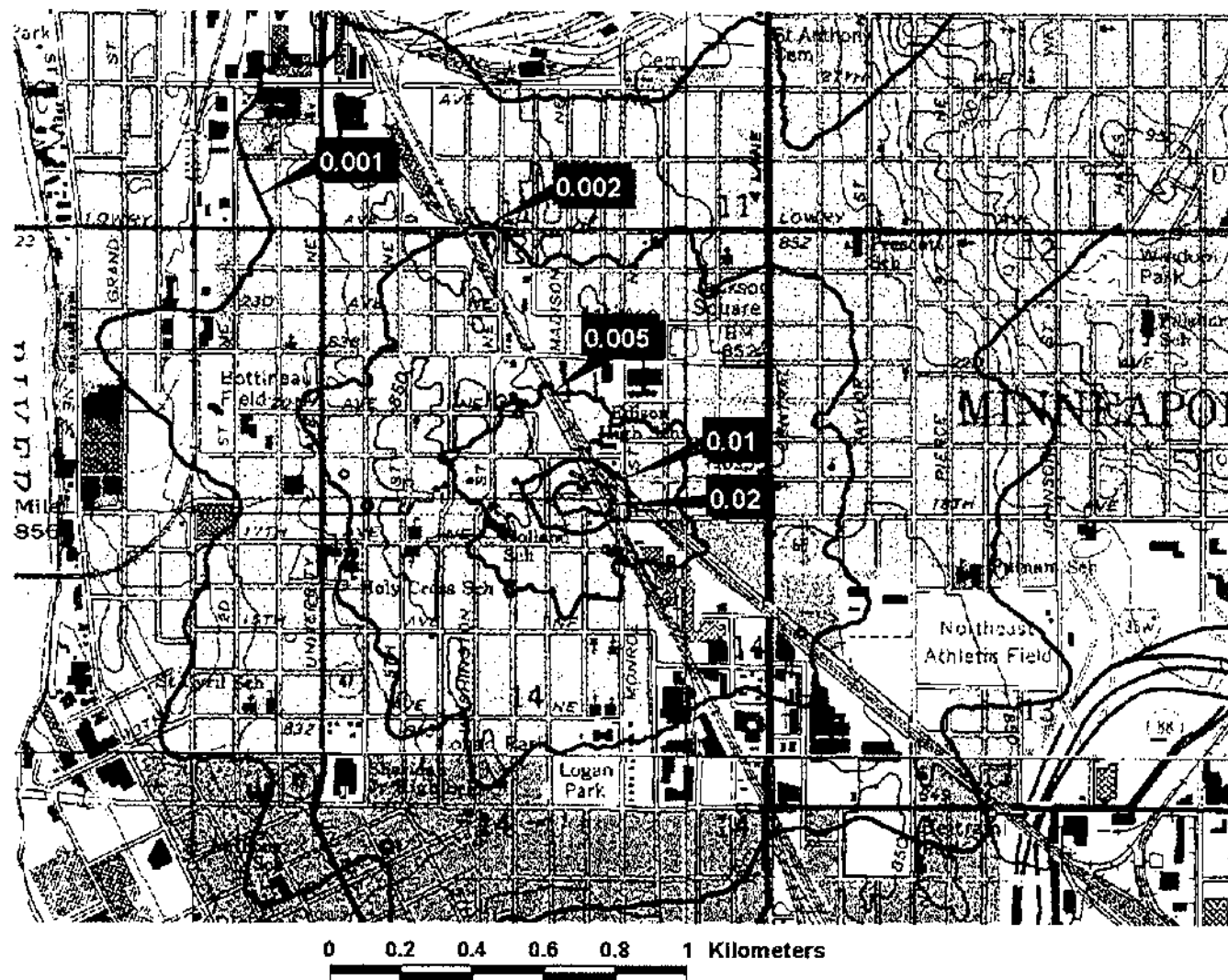


Figure 4. Map showing isopleths of the model-predicted maximum one-hour average concentrations of airborne tremolite fibers for the post-baghouse (1972-1989) case. Concentrations are in units of fibers per cubic centimeter of air (fibers/cc).



Figure 5. Map showing isopleths of the model-predicted maximum 24-hour average concentrations of airborne tremolite fibers for the post-baghouse (1972-1989) case. Concentrations are in units of fibers per cubic centimeter of air (fibers/cc).

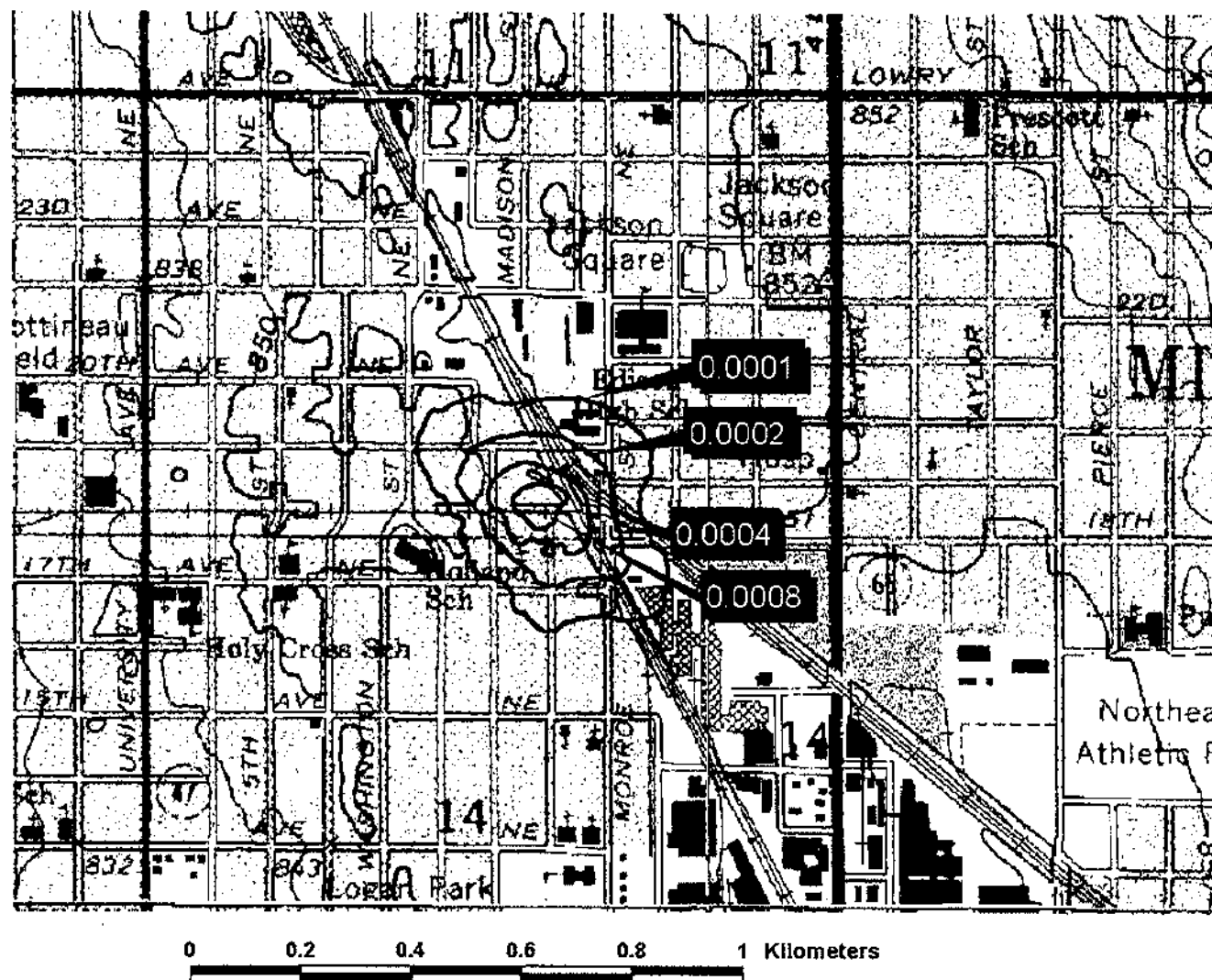


Figure 6. Map showing isopleths of the model-predicted long-term average concentrations of airborne tremolite fibers for the post-baghouse (1972-1989) case. Concentrations are in units of fibers per cubic centimeter of air (fibers/cc).

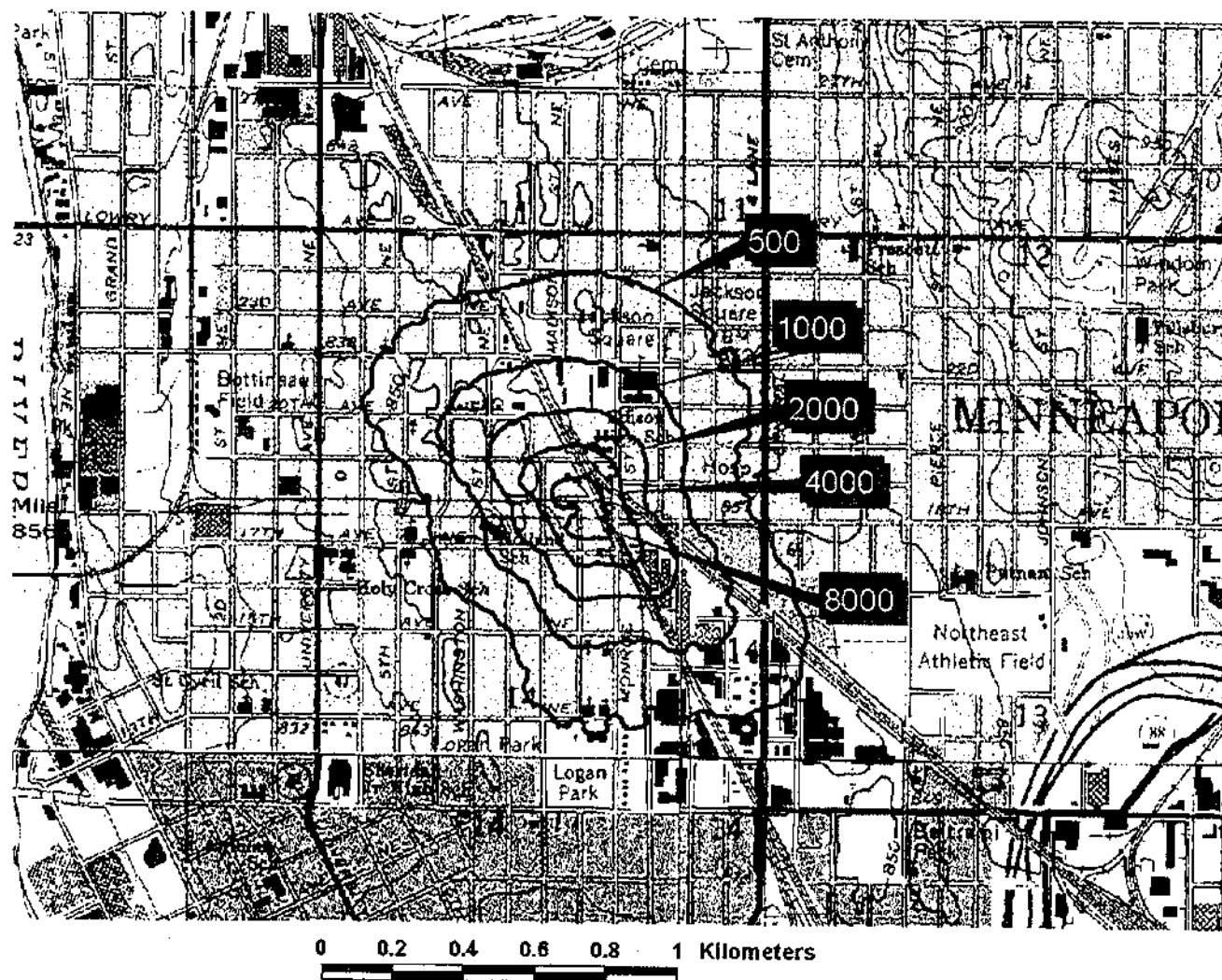


Figure 7. Map showing isopleths of the model-predicted deposition of tremolite fibers for the post-baghouse (1972-1989) case. Concentrations are in units of fibers deposited per square meter of land area (fibers/m<sup>2</sup>).

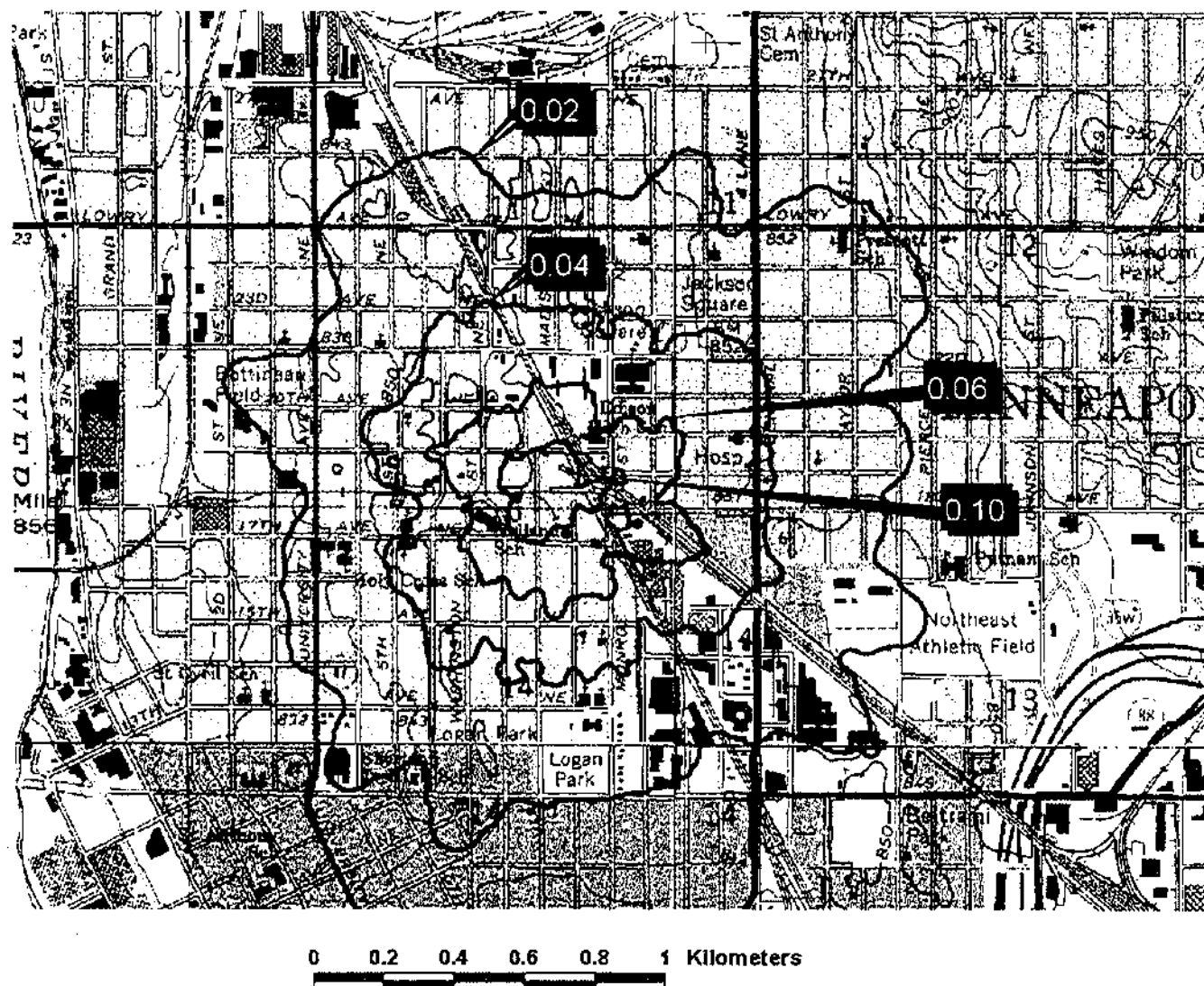


Figure 8. Map showing isopleths of the model-predicted maximum one-hour average concentrations of airborne tremolite fibers for the pre-baghouse (1936-1972) case. Concentrations are in units of fibers per cubic centimeter of air (fibers/cc).



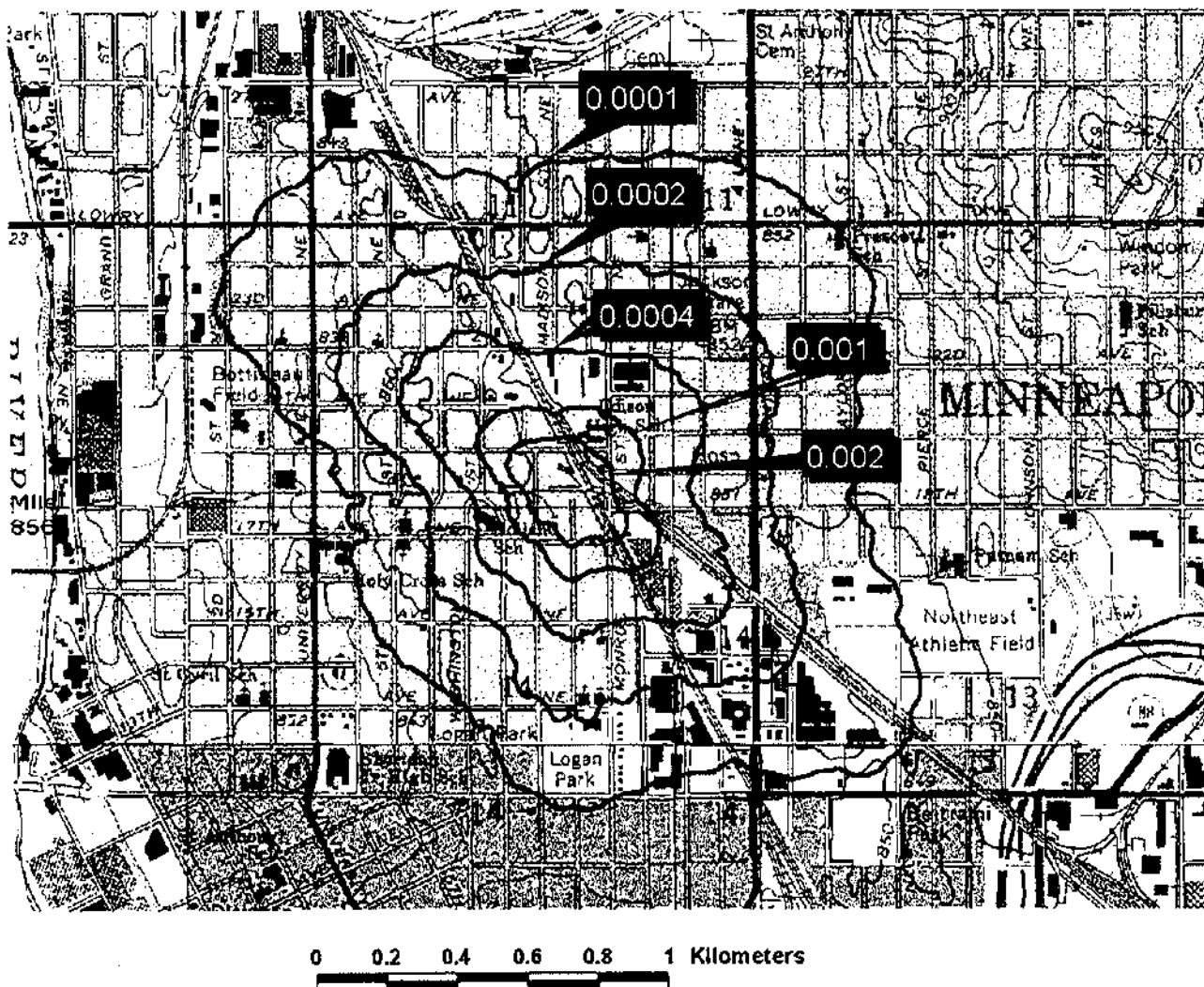


Figure 10. Map showing isopleths of the model-predicted long-term average concentrations of airborne tremolite fibers for the pre-baghouse (1936-1972) case. Concentrations are in units of fibers per cubic centimeter of air (fibers/cc).



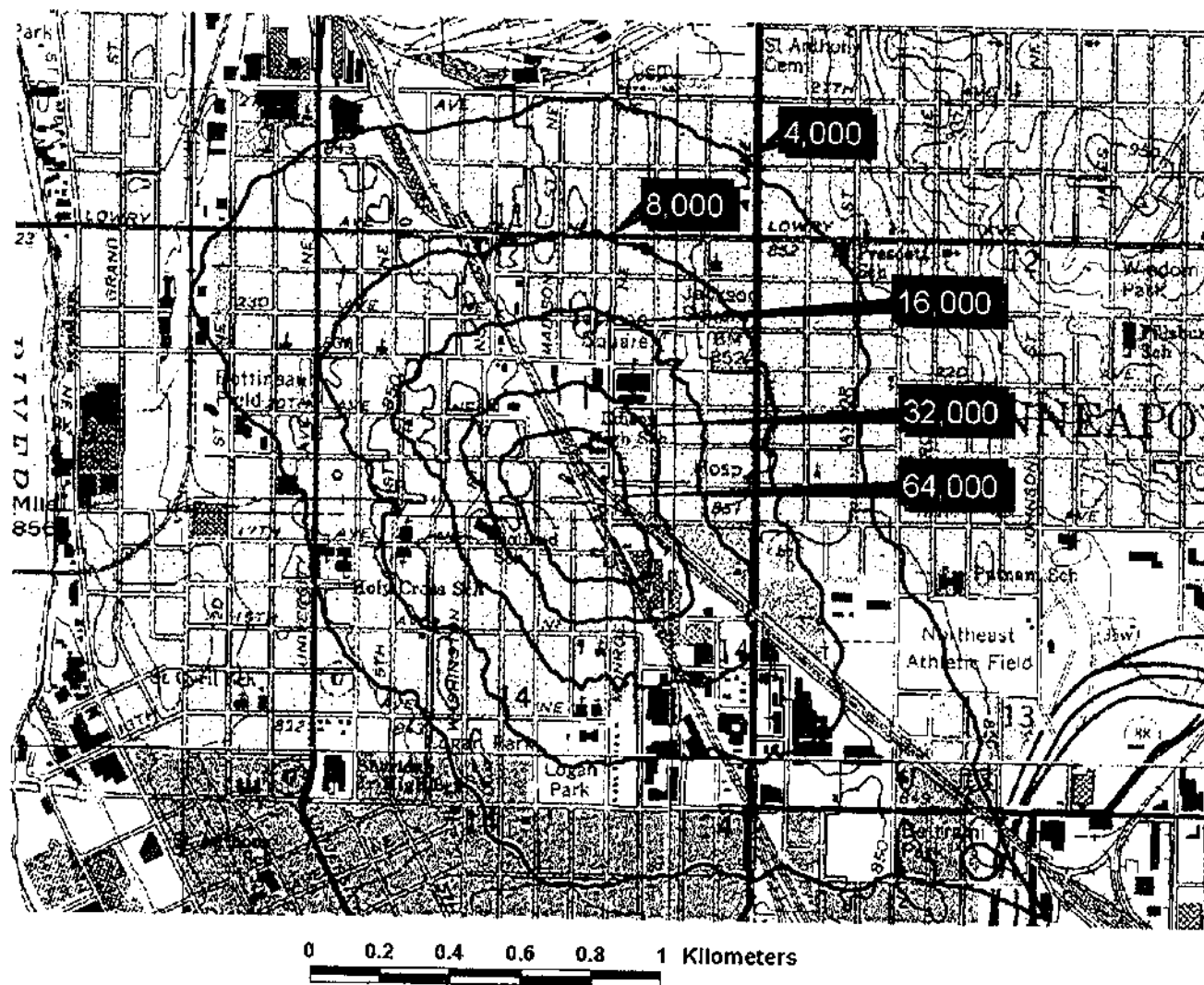


Figure 11. Map showing isopleths of the model-predicted deposition of tremolite fibers for the pre-baghouse (1936-1972) case. Concentrations are in units of fibers deposited per square meter of land area (fibers/m<sup>2</sup>).

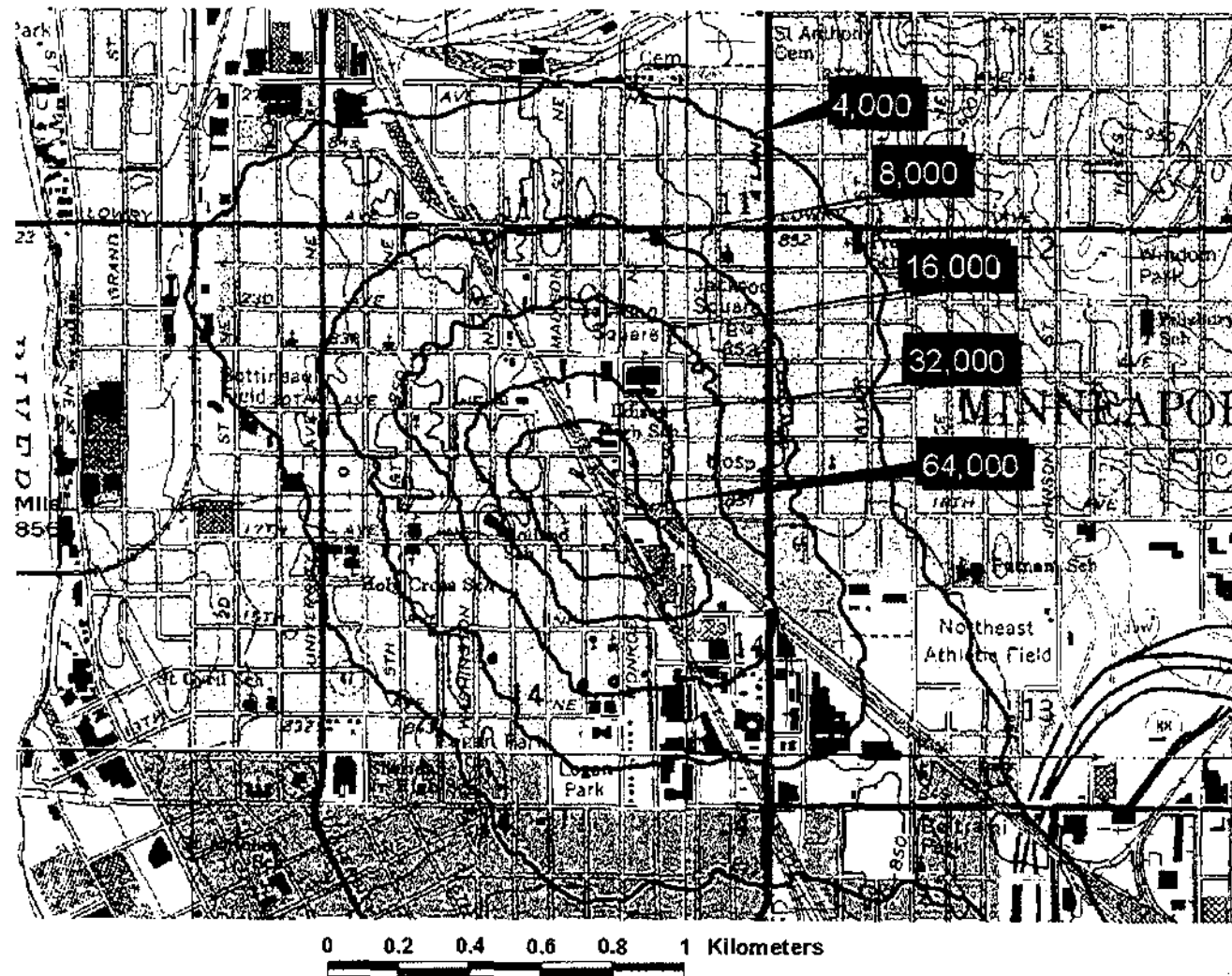


Figure 12. Map showing isopleths of the total model-predicted deposition of tremolite fibers for the period of operation of the facility (1936-1989). Concentrations are in units of fibers deposited per square meter of land area (fibers/m<sup>2</sup>).

**Attachment 1 - Emissions.xls - Stacks**

							lower bound			upper bound		
Source	Stack Height (m)	Stack Diameter (m)	Exit Velocity (m/s)	Stack Exit Temperature (K)	Reported 1977 Stack Emissions (tpy PM10)	Reported 1985 Stack Emissions (tpy PM10)	% Tremo-lite	Tremo-lite Emissions (tpy)	Tremo-lite Emissions (g/s)	% Tremo-lite	Tremo-lite Emissions (tpy)	Tremo-lite Emissions (g/s)
<b>Post 1972 Baghouse Installation</b>							<b>Post 1972 Baghouse Installation</b>					
Stack 1	15.24	0.6096	8.128	383	0.12	0.06	1%	6.00E-04	1.73E-05	3%	3.60E-03	1.04E-04
Stack 2	15.24	0.6096	8.128	383	0.12	0.06	1%	6.00E-04	1.73E-05	3%	3.60E-03	1.04E-04
Stack 3	15.24	0.3810	12.39	273	0.10	0.02	0.50%	1.00E-04	2.88E-06	3%	3.00E-03	8.63E-05
<b>Pre 1972 Baghouse Installation</b>							<b>Pre 1972 Baghouse Installation</b>					
Stack 1	15.24	0.6096	8.128	383			1%			3%		
Stack 2	15.24	0.6096	8.128	383			1%			3%		
Stack 3	15.24	0.3810	12.39	273	0.10	0.02	0.50%	1.00E-04	2.88E-06	3%	3.00E-03	8.63E-05

Based on 1977 and 1985 Reported Stack Emissions  
See Next Page For Alternate (Preferred) Calculation

**Attachment 1 - Emissions.xls - Stacks**

Source	lower bound					upper bound					Average
	PM10 Emissions					PM10 Emissions					
	Estimated Baghouse Loading (lb/hr)	Estimated Baghouse Efficiency (%)	Calculated from Loading and Efficiency (tpy PM10)	Calculated Tremolite Emissions (tpy)	Calculated Tremolite Emissions (g/s)	Estimated Baghouse Loading (lb/hr)	Estimated Baghouse Efficiency (%)	Calculated from Loading and Efficiency (tpy PM10)	Calculated Tremolite Emissions (tpy)	Calculated Tremolite Emissions (g/s)	Calculated Tremolite Emissions (g/s)
<b>Post 1972 Baghouse Installation</b>											
Stack 1	15	99.5%	0.329	0.0033	9.45E-05	20	99%	0.876	0.0263	7.56E-04	4.25E-04
Stack 2	15	99.5%	0.329	0.0033	9.45E-05	20	99%	0.876	0.0263	7.56E-04	4.25E-04
Stack 3		99.5%			2.88E-06		99%			4.46E-05	2.37E-05
<b>Pre 1972 Baghouse Installation</b>											
Stack 1	15	85%	9.855	0.0986	2.83E-03	20	85%	13.140	0.3942	1.13E-02	7.09E-03
Stack 2	15	85%	9.855	0.0986	2.83E-03	20	85%	13.140	0.3942	1.13E-02	7.09E-03
Stack 3		85%			2.88E-06		85%			4.46E-05	2.37E-05

Based on Estimated Baghouse Loading and Baghouse Efficiency

Attachment 2 - Emissions.xls - Fugitives

Source	emission factor	units	Data Source	Mg loaded (e) or unloaded (b) per hour	VMT (c)	PM10 Emissions (kg/hr)	PM10 Emissions (g/s)	Area (m2)	PM10 Emissions (g/m2/s)	Average Case		Post 1972 / Lower Bound		Pre 1972 / Upper Bound	
										% Tremolite	Tremolite Emissions (g/m2/s)	% Tremolite	Tremolite Emissions (g/m2/s)	% Tremolite	Tremolite Emissions (g/m2/s)
Rail Unloading	0.013	kg/Mg	AP-42 (d)	1.02		0.01328	0.0036833	172.8	2.132E-05	4.09	8.72E-07	3.52	7.50E-07	4.38	9.34E-07
Rail Loading	0.0065	kg/Mg	(d)	0.2455		0.0016023	0.0004461	28.15	1.525E-06	1.75	2.67E-09	0.50	7.99E-09	3.00	4.58E-08
Waste Pile - wind erosion	6.48E-06	g/m2/s	AP-42 (f)					64	6.48E-06	6.00	3.89E-07	2.00	1.30E-07	10.00	6.48E-07
Waste Pile - handling	0.083402	kg/Mg	AP-42 (g)	0.017		0.00142	0.0003938	64	6.154E-06	6.00	3.69E-07	2.00	1.23E-07	10.00	6.15E-07
Sum Waste Pile											7.59E-07		2.53E-07		1.28E-06
Truck Loading	0.0065	kg/Mg	(d)	0.2455		0.0016023	0.0004451	1080	4.121E-07	1.75	7.21E-09	0.50	2.06E-09	3.00	1.24E-08
Unpaved Loading Area (h)	0.859183	lb/VMT	AP-42 (a)		66.5	0.0029567	0.0008213	1080	7.605E-07	4.50	3.42E-08	0.05	3.80E-10	8.00	6.08E-08
Sum Truck Loading Area											4.14E-08		2.44E-08		7.32E-08

Note: Fugitive sources are assumed to be operative 24 hours per day, 365 days per year  
 I.e., the emissions are calculated based upon the level of activity and are then an average amount is assumed to occur continuously

equations:

- a AP-42 Section 13.2.2 Unpaved Roads  

$$E = (k * (s/12)^a * (W/3)^b) / (M/0.2)^c * (S/15) * ((365-p)/365)$$
 where:  
 E = emissions in lb/VMT  
 k = constant (lb/VMT) = 2.8 for PM10  
 s = silt content (%) = 8%  
 a = empirically-derived exponent = 0.8  
 W = mean vehicle weight (tons) = 5  
 b = empirically-derived exponent = 0.4  
 M = baseline moisture content = 0.2  
 c = empirically derived exponent = 0.3  
 S = mean vehicle speed (mph) = 8  
 p = mean number of days with > 0.01 inches of precipitation = 110
- b assumes total activity 1958 to 1988 (see J. Kelly spreadsheet)  
 total tons shipped = 138,207 over 31 years = 4458 tpy = 0.51 tpy  
 This amount is transferred twice, once from rail to site and then from site to hopper (neither of these transfer points are covered by the baghouse system) = 1.02 tpy  
 Waste pile: assume 170 tpy is waste = 154 Mg/y = 0.017 Mg/h = 17 kg/h
- c assumes 1/2 of product shipped by truck, and each truck carries 2 tons of product, and total amount of product shipped = 4458-170 = 4288 tpy, and therefore there are 4288 / 2 / 2 = 1072 truck trips per year, and each truck travels 100 meters = 0.062 miles
- d Emission factor for rail unloading from AP-42 Section 11.28 Vermiculite Processing  
 No emission factors are available for rail loading and truck loading  
 The assumption is made that loading emissions are 1/2 of unloading emissions
- e assumes total product loaded = amount unloaded (4458 tpy) minus waste (=170 tpy), and 1/2 is by truck and 1/2 is by rail

## Attachment 2 - Emissions.xls - Fugitives

- f AP-42 section 13.2.5-1 Industrial Wind Erosion  
 $E \text{ (g/m}^2\text{)} = k * \text{sum over number of days with disturbances per year (erosion potential)}$   
 $k = 0.5 \text{ for PM}_{10}$   
 number of days with disturbances per year assumed to be 365  
 $\text{erosion potential} = 58 * (u^* - u_t^*)^2 + 25 * (u^* - u_t^*)$   
 $u^* = \text{friction velocity for the fastest mile of wind for period between disturbances}$   
 $u_t^* = \text{threshold friction velocity} = 0.54 \text{ (assumed equivalent to fine coal dust)}$

- g AP-42 Section 13.2.4 Aggregate Handling and Storage Piles (material drop)  
 $E \text{ (kg/Mg)} = k * 0.0016 * ((U/2.2)^{1.3} / (M/2)^{1.4})$   
 where:  
 $k = \text{particle size multiplier} = 0.35 \text{ for PM}_{10}$   
 $U = \text{mean wind speed (mph)} = 11$   
 $M = \text{material moisture content (\%)} = 0.25$

- h The percent tremolite is taken from a fax from J. Kelly showing the results of soils testing in the area around the facility

note: density of tremolite assumed to be  $3.3e7 \text{ fibers/mg} = 3.3e4 \text{ fibers/ug} = 3.03e-5 \text{ ug/fiber}$   
 fibers have approximate dimensions of  $0.5 \text{ um} \times 25 \text{ um}$   
 $\text{OSHA level} = 0.1 \text{ fibers/cc} = 5E-13 \text{ g/cc} = 0.5 \text{ ug/m}^3$   
 $\text{MDH indoor level} = 0.01 \text{ fibers/cc} = 5E-14 \text{ g/cc} = 0.05 \text{ ug/m}^3$   
 $\text{ug/m}^3 * 3.3e7 \text{ fibers/mg} * 10e-3 \text{ mg/ug} * 10e-6 \text{ m}^3/\text{cc} = \text{fibers/cc}$  [i.e.,  $\text{ug/m}^3 * 3.3e-2 = \text{fibers/cc}$ ]  
 $\text{ug/m}^3/\text{time} * 3.3e-7 \text{ fibers/mg} * 10e-3 \text{ mg/ug} = \text{fibers/m}^2/\text{time}$  [i.e.,  $\text{ug/m}^2/\text{time} * 3.3e4 = \text{fibers/m}^2/\text{time}$ ]

## Note:

PER CONC = Long-term average airborne tremolite fiber concentration (ug/m3 = micrograms per cubic meter)

24HR CONC = The maximum 24-hour average airborne tremolite fiber concentration (ug/m3)

1HR CONC = The maximum 1-hour average airborne tremolite fiber concentration (ug/m3)

PER DEP = Total deposition of tremolite fibers (g/m2 = grams per square meter)

The Pre-baghouse time period was considered to be 20 years (1952 to 1972)

The Post-baghouse time period was considered to be 18 years (1972 - 1989)

HOUSENO	STREET	PIN	NAME	ZIP	X COORD	Y COORD	ELEVATION (M)
---------	--------	-----	------	-----	---------	---------	---------------

# Non-Responsive

## Note:

PER CONC = Long-term average airborne tremolite fiber concentration (ug/m3 = micrograms per cubic meter)

24HR CONC = The maximum 24-hour average airborne tremolite fiber concentration (ug/m3)

1HR CONC = The maximum 1-hour average airborne tremolite fiber concentration (ug/m3)

YY-YY DEP = Total deposition of tremolite fibers (fibers/m2 = fibers per square meter)

The Pre-baghouse time period (YY-YY) was considered to be 36 years (1936 to 1972)

The Post-baghouse time period (YY-YY) was considered to be 18 years (1972 - 1989)

HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
1	Non-Responsive	0.00003564	887	0.00042603	0.00342969	0.00044616	19,780	0.00570867	0.04378209	20,668
2		0.00003531	872	0.00041382	0.00354816	0.00044088	19,450	0.00555588	0.04425762	20,322
3		0.00003498	854	0.00038049	0.00386397	0.00043824	19,067	0.00511599	0.04929639	19,922
4		0.00003597	971	0.00061347	0.00562617	0.00043758	21,295	0.00697389	0.06971943	22,265
5		0.00002970	820	0.00055110	0.00510873	0.00036069	17,980	0.00644061	0.06477537	18,800
6		0.00002739	767	0.00052734	0.00486948	0.00033495	16,858	0.00622083	0.06225747	17,625
7		0.00002508	710	0.00049995	0.00457842	0.00030690	15,593	0.00596145	0.05906043	16,303
8		0.00002277	647	0.00046167	0.00427845	0.00027753	14,207	0.00554301	0.05560137	14,854
9		0.00002112	619	0.00045078	0.00382800	0.00026070	13,597	0.00548361	0.05031345	14,216
10		0.00002838	808	0.00056859	0.00461076	0.00034650	17,741	0.00678348	0.05945973	18,549
11		0.00002475	733	0.00053196	0.00387618	0.00030525	16,115	0.00645414	0.05154171	16,848
12		0.00002211	676	0.00050622	0.00424479	0.00027324	14,872	0.00621786	0.04955313	15,548
13		0.00002013	638	0.00047784	0.00523677	0.00025146	14,042	0.00593769	0.06261915	14,680
14		0.00003993	936	0.00041382	0.00329934	0.00048906	20,630	0.00541101	0.04368309	21,566
15		0.00003861	908	0.00040029	0.00323169	0.00047421	20,016	0.00534633	0.04313562	20,923
16		0.00003729	879	0.00038610	0.00315282	0.00046002	19,452	0.00515097	0.04183080	20,331
17		0.00003597	853	0.00036135	0.00301521	0.00044352	18,887	0.00481602	0.03973860	19,740
18		0.00003729	906	0.00040953	0.00393459	0.00046662	20,220	0.00549351	0.04996035	21,126
19		0.00003927	946	0.00042999	0.00380820	0.00048906	21,087	0.00575916	0.04819122	22,033
20		0.00004125	990	0.00044220	0.00401082	0.00051381	22,039	0.00590997	0.04951419	23,029
21		0.00004356	1,037	0.00044121	0.00404448	0.00054054	23,069	0.00588258	0.04981317	24,106
22		0.00004488	1,060	0.00043758	0.00365112	0.00055440	23,534	0.00580833	0.04844730	24,594
23		0.00004950	1,165	0.00046893	0.00411972	0.00060918	25,896	0.00621522	0.05053389	27,062
24		0.00004719	1,110	0.00046398	0.00364782	0.00058179	24,594	0.00614559	0.04791303	25,703
25		0.00005940	1,366	0.00060588	0.00428934	0.00071742	30,011	0.00771705	0.05562447	31,377
26		0.00006072	1,398	0.00064020	0.00417318	0.00073260	30,666	0.00824868	0.05392497	32,065
27		0.00006237	1,432	0.00070950	0.00453519	0.00075174	31,393	0.00920799	0.05827074	32,824
28		0.00006468	1,495	0.00082467	0.00502722	0.00077979	32,716	0.01085502	0.06459387	34,210
29		0.00005973	1,396	0.00078969	0.00489918	0.00072039	30,530	0.01049367	0.06362598	31,926
30		0.00006996	1,599	0.00084579	0.00509916	0.00084051	35,018	0.01102926	0.06542613	36,617



<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
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# Non-Responsive

HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
31	Non-Responsive	0.00005511	1,310	0.00073623	0.00454113	0.00066429	28,657	0.00982971	0.05911818	29,967
32		0.00004488	1,104	0.00059499	0.00397188	0.00054384	24,146	0.00806982	0.05175027	25,250
33		0.00003861	969	0.00048675	0.00376398	0.00046662	21,188	0.00666897	0.04903173	22,157
34		0.00003564	909	0.00044451	0.00369963	0.00043296	19,887	0.00596970	0.04848129	20,796
35		0.00004158	1,037	0.00054153	0.00378213	0.00050490	22,689	0.00738408	0.04897002	23,726
36		0.00004290	1,028	0.00059400	0.00381909	0.00051777	22,443	0.00796785	0.05035008	23,471
37		0.00004224	1,026	0.00058905	0.00374616	0.00051249	22,439	0.00795135	0.04959933	23,466
38		0.00004323	1,029	0.00058476	0.00374055	0.00052437	22,515	0.00778998	0.04901325	23,543
39		0.00003399	835	0.00048345	0.00323136	0.00041151	18,266	0.00657195	0.04264029	19,101
40		0.00003234	817	0.00043659	0.00314226	0.00039435	17,889	0.00598257	0.04166976	18,707
41		0.00003102	808	0.00043263	0.00391974	0.00037620	17,672	0.00510642	0.04883241	18,479
42		0.00003333	860	0.00043791	0.00382107	0.00040458	18,824	0.00534303	0.04747314	19,684
43		0.00002673	714	0.00041844	0.00402699	0.00032538	15,634	0.00470316	0.05093847	16,348
44		0.00002871	762	0.00042768	0.00400884	0.00035046	16,654	0.00490050	0.05036823	17,415
45		0.00001155	385	0.00032010	0.00409167	0.00014619	8,465	0.00413919	0.05236143	8,849
46		0.00001254	404	0.00033132	0.00354948	0.00015609	8,886	0.00422202	0.04445661	9,290
47		0.00001320	416	0.00033726	0.00317493	0.00016236	9,136	0.00427812	0.03950298	9,552
48		0.00001353	429	0.00034254	0.00274362	0.00016929	9,419	0.00432762	0.03395898	9,848
49		0.00001683	546	0.00045969	0.00513744	0.00021021	12,015	0.00566346	0.06378834	12,561
50		0.00001980	592	0.00044286	0.00326172	0.00024288	13,020	0.00545721	0.04380321	13,612
51		0.00001749	548	0.00042405	0.00368214	0.00021780	12,032	0.00528726	0.04435992	12,580
52		0.00001584	511	0.00039996	0.00464541	0.00019767	11,233	0.00505131	0.05726292	11,743
53		0.00004389	1,186	0.00076989	0.00639144	0.00053328	26,087	0.00876348	0.07834101	27,272
54		0.00003828	1,082	0.00073689	0.00535095	0.00047058	23,845	0.00861729	0.06893040	24,927
55		0.00003399	992	0.00069432	0.00461934	0.00041844	21,845	0.00822360	0.05832750	22,837
56		0.00003102	937	0.00065835	0.00584034	0.00038610	20,659	0.00786885	0.06420084	21,597
57		0.00001518	513	0.00048708	0.00310134	0.00019206	11,207	0.00659637	0.04023360	11,720
58		0.00001683	563	0.00049599	0.00363198	0.00021285	12,320	0.00654159	0.04808067	12,883
59		0.00001320	444	0.00041382	0.00301422	0.00016566	9,714	0.00554103	0.04080384	10,158
60		0.00001023	355	0.00035607	0.00239382	0.00013068	7,772	0.00486420	0.03206544	8,127
61		0.00001056	365	0.00032373	0.00307890	0.00013464	7,985	0.00429297	0.04148661	8,350
62		0.00001023	348	0.00032340	0.00263010	0.00012771	7,609	0.00434478	0.03566178	7,957
63		0.00006171	1,423	0.00057255	0.00438603	0.00075009	31,446	0.00753819	0.05603136	32,870
64		0.00005973	1,380	0.00057288	0.00433752	0.00072732	30,454	0.00756195	0.05582379	31,835
65		0.00005709	1,320	0.00055902	0.00420651	0.00069498	29,068	0.00740520	0.05481631	30,388
66		0.00005445	1,263	0.00053856	0.00408276	0.00066396	27,793	0.00708378	0.05363688	29,056
67		0.00005247	1,215	0.00053559	0.00397419	0.00063756	26,754	0.00674256	0.05173443	27,969
68		0.00004587	1,073	0.00050325	0.00348678	0.00055737	23,558	0.00654621	0.04520736	24,631

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
69	Non-Responsive	0.00004290	1,009	0.00051117	0.00343992	0.00052008	22,128	0.00671352	0.04502058	23,137
70		0.00003960	941	0.00051216	0.00337887	0.00048180	20,618	0.00679008	0.04459356	21,559
71		0.00003663	878	0.00050226	0.00326040	0.00044583	19,208	0.00670956	0.04302903	20,086
72		0.00003333	804	0.00046992	0.00309837	0.00040590	17,598	0.00631224	0.04114209	18,403
73		0.00003267	802	0.00047751	0.00313962	0.00039930	17,521	0.00646602	0.04193607	18,323
74		0.00001716	514	0.00038643	0.00315612	0.00021285	11,294	0.00476454	0.04214298	11,808
75		0.00001650	495	0.00037389	0.00299013	0.00020361	10,892	0.00462759	0.04008411	11,387
76		0.00007326	1,743	0.00084282	0.00601986	0.00087846	38,220	0.01137510	0.07574424	39,963
77		0.00006732	1,624	0.00077583	0.00590304	0.00080817	35,592	0.01017258	0.07496148	37,216
78		0.00006237	1,534	0.00076890	0.00602910	0.00075339	33,666	0.00941853	0.07346130	35,200
79		0.00005775	1,440	0.00074580	0.00597927	0.00069465	31,571	0.00892188	0.06940296	33,011
80		0.00005346	1,356	0.00073359	0.00605583	0.00064647	29,742	0.00854238	0.07102920	31,097
81		0.00004719	1,219	0.00070026	0.00606903	0.00056925	26,740	0.00787017	0.07258779	27,959
82		0.00007524	1,705	0.00084909	0.00520113	0.00090321	37,392	0.01094808	0.06593499	39,097
83		0.00002739	871	0.00074217	0.00556743	0.00034155	19,081	0.00923175	0.06871557	19,952
84		0.00003234	883	0.00058014	0.00536646	0.00039270	19,358	0.00670164	0.06736455	20,241
85		0.00003069	824	0.00048345	0.00367026	0.00036861	18,303	0.00586245	0.04438335	19,128
86		0.00003036	796	0.00051150	0.00349338	0.00036630	17,673	0.00641091	0.04177833	18,469
87		0.00003036	810	0.00050226	0.00358083	0.00036729	17,996	0.00620103	0.04386591	18,806
88		0.00003003	775	0.00050556	0.00332343	0.00035904	17,188	0.00633039	0.03988380	17,963
89		0.00002838	752	0.00046992	0.00347655	0.00034155	16,693	0.00582054	0.04308348	17,445
90		0.00003003	687	0.00041448	0.00353331	0.00036333	15,377	0.00490611	0.04326828	16,063
91		0.00003102	710	0.00041976	0.00363693	0.00037290	15,905	0.00493845	0.04537302	16,616
92		0.00003168	737	0.00041745	0.00370656	0.00038247	16,470	0.00540870	0.04549710	17,206
93		0.00003003	855	0.00038577	0.00316800	0.00036597	19,054	0.00489324	0.04117443	19,909
94		0.00002805	808	0.00037554	0.00299640	0.00034452	17,992	0.00480612	0.03936570	18,800
95		0.00002640	762	0.00036531	0.00287496	0.00032472	16,988	0.00470910	0.03783186	17,750
96		0.00002937	901	0.00043065	0.00329142	0.00036663	20,131	0.00535062	0.04336035	21,031
97		0.00002937	880	0.00040854	0.00317262	0.00036498	19,693	0.00525129	0.04187073	20,573
98		0.00002937	892	0.00043098	0.00331155	0.00036663	19,949	0.00540870	0.04388604	20,841
99		0.00002541	779	0.00038808	0.00307164	0.00032142	17,442	0.00489852	0.04110645	18,221
100		0.00002706	824	0.00040722	0.00319638	0.00034023	18,440	0.00513612	0.04270101	19,264
101		0.00002475	785	0.00034485	0.00296637	0.00031581	17,576	0.00435633	0.03987951	18,362
102		0.00002574	816	0.00035607	0.00304689	0.00032868	18,275	0.00449295	0.04089624	19,092
103		0.00002706	853	0.00036861	0.00313500	0.00034320	19,091	0.00464211	0.04199745	19,944
104		0.00002904	916	0.00036828	0.00343299	0.00036630	20,483	0.00458667	0.04567431	21,399
105		0.00002937	918	0.00040491	0.00319671	0.00037224	20,552	0.00511434	0.04192914	21,471
106		0.00002739	897	0.00034980	0.00343629	0.00034980	20,055	0.00462660	0.04550238	20,952

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
107	Non-Responsive	0.00002541	834	0.00033198	0.00325116	0.00032505	18,660	0.00441045	0.04324287	19,493
108		0.00002409	785	0.00031779	0.00309903	0.00030591	17,569	0.00423060	0.04135461	18,354
109		0.00002310	754	0.00030822	0.00300036	0.00029370	16,878	0.00411279	0.04012701	17,632
110		0.00002244	733	0.00028974	0.00305283	0.00028776	16,390	0.00392799	0.04104507	17,123
111		0.00002871	804	0.00043164	0.00334719	0.00035970	17,984	0.00560571	0.04264095	18,789
112		0.00003663	920	0.00042702	0.00406329	0.00045573	20,505	0.00569184	0.05160573	21,424
113		0.00003498	985	0.00049401	0.00419826	0.00043890	22,000	0.00633633	0.05260332	22,985
114		0.00003531	1,142	0.00040755	0.00398937	0.00044616	25,461	0.00540342	0.05183508	26,602
115		0.00003630	966	0.00053790	0.00406560	0.00045573	21,538	0.00700755	0.05008047	22,504
116		0.00005709	1,358	0.00058179	0.00458832	0.00070356	30,233	0.00765435	0.05485425	31,591
117		0.00005181	1,232	0.00052734	0.00443124	0.00064152	27,403	0.00697323	0.05266965	28,635
118		0.00005346	1,284	0.00054384	0.00471933	0.00066099	28,613	0.00717915	0.05678739	29,897
119		0.00004917	1,183	0.00050358	0.00456423	0.00060786	26,364	0.00667689	0.05569575	27,547
120		0.00004620	1,120	0.00049665	0.00435600	0.00057189	24,984	0.00654390	0.05333130	26,104
121		0.00004323	1,060	0.00048840	0.00393921	0.00053658	23,621	0.00651024	0.04835292	24,681
122		0.00004059	1,004	0.00047421	0.00370854	0.00050523	22,390	0.00632643	0.04667817	23,394
123		0.00005973	1,595	0.00073590	0.00467016	0.00073161	35,490	0.00894498	0.05862648	37,085
124		0.00005874	1,459	0.00061644	0.00505131	0.00072039	32,464	0.00801339	0.05916306	33,923
125		0.00006402	1,573	0.00068376	0.00500709	0.00078474	35,010	0.00888162	0.05794569	36,583
126		0.00008712	2,218	0.00123453	0.00483384	0.00098637	49,320	0.01419528	0.05543736	51,538
127		0.00009009	2,230	0.00082170	0.00527604	0.00108075	49,544	0.01025508	0.06071142	51,773
128		0.00008151	2,042	0.00083127	0.00508695	0.00098835	45,397	0.00997029	0.06116979	47,440
129		0.00007920	1,909	0.00083028	0.00473913	0.00096393	42,493	0.01044681	0.06016725	44,402
130		0.00007557	1,788	0.00073128	0.00529122	0.00092004	39,790	0.00917400	0.05863341	41,578
131		0.00008415	1,983	0.00079860	0.00541629	0.00102234	44,132	0.00998481	0.06281517	46,115
132		0.00009141	2,042	0.00086658	0.00551463	0.00108867	44,857	0.01074348	0.06868851	46,899
133		0.00008085	1,815	0.00083721	0.00512127	0.00096888	39,846	0.01079166	0.06700122	41,661
134		0.00008580	1,928	0.00084084	0.00523875	0.00102465	42,309	0.01062435	0.06748995	44,237
135		0.00007689	1,743	0.00071808	0.00504867	0.00092433	38,321	0.00947100	0.06448200	40,064
136		0.00007227	1,654	0.00067584	0.00486354	0.00087483	36,452	0.00887370	0.06153576	38,105
137		0.00004587	1,308	0.00087450	0.00611688	0.00056595	28,876	0.01003860	0.07227132	30,184
138		0.00005214	1,428	0.00094149	0.00646767	0.00063756	31,532	0.01067946	0.08194857	32,959
139		0.00006072	1,578	0.00099495	0.00755799	0.00073260	34,749	0.01095600	0.08890134	36,327
140		0.00006963	1,730	0.00099528	0.00796158	0.00083853	38,064	0.01135827	0.09126678	39,793
141		0.00025377	5,295	0.00209385	0.00864600	0.00283437	120,073	0.02409792	0.10790868	125,368
142		0.00016566	3,680	0.00148764	0.00634722	0.00172458	84,221	0.01528395	0.07000950	87,902
143		0.00029271	4,228	0.00359700	0.01732236	0.00296802	99,576	0.04217367	0.13001142	103,804
144		0.00025542	4,148	0.00334719	0.01252020	0.00258555	96,895	0.03792426	0.13015563	101,044

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
145	<h1>Non-Responsive</h1>						
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
145	Non-Responsive	0.00022935	4,065	0.00266772	0.01079199	0.00241428	94,838	0.03247992	0.13165977	98,903
146		0.00034353	4,596	0.00538065	0.02208558	0.00347391	109,609	0.04629834	0.16685823	114,205
147		0.00015972	3,282	0.00309210	0.01331616	0.00184272	75,480	0.03240501	0.14505810	78,762
148		0.00014520	3,090	0.00214665	0.01055835	0.00159522	69,973	0.02756556	0.12464100	73,063
149		0.00009075	2,326	0.00182292	0.00761442	0.00106656	51,692	0.02215950	0.09324447	54,018
150		0.00006072	1,718	0.00142395	0.00723261	0.00074019	37,864	0.01738737	0.09758793	39,581
151		0.00006996	1,624	0.00061710	0.00480777	0.00085239	36,030	0.00801933	0.06147735	37,654
152		0.00006732	1,565	0.00060390	0.00476916	0.00082269	34,670	0.00782661	0.06158691	36,234
153		0.00006567	1,518	0.00059961	0.00459756	0.00079893	33,607	0.00779955	0.05974056	35,125
154		0.00006369	1,470	0.00058740	0.00439164	0.00077418	32,500	0.00765831	0.05626566	33,969
155		0.00004653	1,243	0.00065208	0.00423621	0.00058080	27,716	0.00830577	0.05449653	28,959
156		0.00004884	1,429	0.00053625	0.00543246	0.00060753	31,852	0.00718542	0.06412989	33,281
157		0.00008316	2,420	0.00075834	0.00592680	0.00100683	53,739	0.01001517	0.07056555	56,159
158		0.00010032	2,440	0.00094446	0.00534072	0.00119427	54,236	0.01145364	0.05996166	56,676
159		0.00011220	2,660	0.00110319	0.00558624	0.00133848	59,244	0.01318053	0.06991413	61,904
160		0.00014388	3,320	0.00135960	0.00650859	0.00168168	74,139	0.01595847	0.08146215	77,460
161		0.00013959	3,192	0.00129888	0.00634689	0.00164010	71,234	0.01566774	0.07933530	74,427
162		0.00013431	3,047	0.00113883	0.00632610	0.00158499	67,940	0.01400487	0.07992864	70,987
163		0.00012870	2,900	0.00105831	0.00621357	0.00152229	64,536	0.01299243	0.07877826	67,436
164		0.00012309	2,754	0.00096855	0.00624492	0.00145563	61,152	0.01198824	0.07485456	63,906
165		0.00011715	2,616	0.00091245	0.00635118	0.00138930	57,941	0.01116159	0.07664085	60,557
166		0.00011154	2,478	0.00090090	0.00592383	0.00132099	54,769	0.01153614	0.07315044	57,247
167		0.00010560	2,347	0.00092796	0.00589545	0.00125400	51,747	0.01200573	0.07080777	54,095
168		0.00009735	2,236	0.00085107	0.00538626	0.00117216	49,641	0.01078242	0.06773943	51,876
169		0.00009108	2,111	0.00083094	0.00523578	0.00109857	46,934	0.01057683	0.06475326	49,045
170		0.00023067	4,744	0.00164967	0.00840840	0.00261129	106,698	0.02110878	0.10190532	111,442
171		0.00021186	4,315	0.00154341	0.00782595	0.00241032	96,323	0.01887963	0.10075230	100,638
172		0.00019899	4,039	0.00159885	0.00781473	0.00226974	89,734	0.02017191	0.09787833	93,773
173		0.00018546	3,777	0.00154209	0.00763884	0.00212751	83,600	0.01984554	0.09546768	87,376
174		0.00016698	3,437	0.00143088	0.00806751	0.00193050	75,856	0.01744215	0.10377609	79,293
175		0.00015246	3,178	0.00140778	0.00778074	0.00177507	69,995	0.01765896	0.10148721	73,173
176		0.00013860	2,934	0.00139524	0.00728475	0.00162459	64,564	0.01728375	0.09415725	67,498
177		0.00012507	2,694	0.00137082	0.00728904	0.00147411	59,208	0.01738143	0.08917491	61,902
178		0.00022407	4,354	0.00199056	0.00989835	0.00253143	97,574	0.02536050	0.12314808	101,928
179		0.00005346	1,598	0.00070785	0.00478203	0.00065604	35,654	0.00862465	0.06045864	37,252
180		0.00010593	2,663	0.00143781	0.00530904	0.00117546	59,370	0.01605483	0.05707779	62,034
181		0.00012705	3,023	0.00152493	0.00580602	0.00137940	67,839	0.01681680	0.06347352	70,862
182		0.00024651	5,761	0.00257895	0.01450515	0.00238293	137,652	0.02242284	0.09512217	143,412



HOUSENO	STREET	PIN	NAME	ZIP	X COORD	Y COORD	ELEVATION (M)
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# Non-Responsive

HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
183	Non-Responsive	0.00012210	3,197	0.00136983	0.00639375	0.00135333	71,339	0.01305084	0.06791862	74,536
184		0.00005808	1,822	0.00056991	0.00498102	0.00071577	40,491	0.00769824	0.06082494	42,313
185		0.00030294	6,438	0.00288882	0.01174569	0.00267498	153,074	0.02568852	0.07659102	159,512
186		0.00021615	4,744	0.00190839	0.00829950	0.00210177	110,082	0.01864764	0.06887892	114,826
187		0.00016830	3,749	0.00153978	0.00652212	0.00173910	85,754	0.01615449	0.06983262	89,503
188		0.00009306	2,113	0.00112365	0.00632577	0.00110880	46,364	0.01485660	0.08000058	48,477
189		0.00008118	1,891	0.00096492	0.00602514	0.00097020	41,477	0.01292181	0.07486578	43,368
190		0.00045408	8,273	0.00352110	0.01199121	0.00445830	196,566	0.03878721	0.13946790	204,840
191		0.00048708	9,541	0.00418242	0.01303599	0.00482262	232,401	0.04824171	0.12073974	241,941
192		0.00047982	9,851	0.00480447	0.03080154	0.00393426	254,586	0.03681909	0.11281875	264,437
193		0.00148731	3,301	0.00765237	0.02806980	0.01479489	84,158	0.10885875	0.25243350	87,459
194		0.00002541	549	0.00046332	0.00357060	0.00032208	12,302	0.00639309	0.04622079	12,851
195		0.00004884	1,108	0.00061908	0.00474837	0.00058179	24,851	0.00733029	0.05429358	25,959
196		0.00005115	1,170	0.00065010	0.00454179	0.00060687	26,233	0.00737220	0.05444010	27,403
197		0.00005379	1,241	0.00065703	0.00466422	0.00063294	27,775	0.00830148	0.05342238	29,017
198		0.00005577	1,310	0.00072897	0.00439395	0.00065670	29,278	0.00929247	0.05351676	30,589
199		0.00005511	1,253	0.00068574	0.00493053	0.00065307	28,100	0.00801042	0.05680653	29,354
200		0.00005808	1,309	0.00070158	0.00490545	0.00068508	29,393	0.00829290	0.05853969	30,702
201		0.00006765	1,538	0.00076560	0.00480018	0.00078606	34,543	0.00903408	0.05890038	36,082
202		0.00005973	1,337	0.00070158	0.00474111	0.00070587	30,043	0.00825000	0.05594160	31,379
203		0.00006171	1,386	0.00067650	0.00447843	0.00072501	31,153	0.00810909	0.05513772	32,540
204		0.00006468	1,446	0.00068574	0.00477873	0.00076065	32,522	0.00820545	0.05799915	33,967
205		0.00008316	1,919	0.00097152	0.00533313	0.00094941	43,019	0.01184304	0.06222843	44,938
206		0.00007755	1,763	0.00090552	0.00534336	0.00089430	39,606	0.00989670	0.06328410	41,369
207		0.00007359	1,664	0.00085008	0.00531069	0.00085635	37,414	0.00983499	0.06448860	39,078
208		0.00007227	1,674	0.00086757	0.00496683	0.00083556	37,493	0.01073952	0.05874858	39,167
209		0.00006798	1,592	0.00085800	0.00478698	0.00078936	35,596	0.01075734	0.05765892	37,188
210		0.00006402	1,512	0.00083259	0.00462033	0.00074580	33,791	0.01050819	0.05613465	35,303
211		0.00006105	1,498	0.00088341	0.00434412	0.00070983	33,341	0.01081212	0.05370057	34,839
212		0.00005940	1,435	0.00082764	0.00435237	0.00069399	31,981	0.01018149	0.05216178	33,416
213		0.00005775	1,373	0.00077220	0.00438603	0.00067650	30,637	0.00972609	0.05367285	32,010
214		0.00003333	716	0.00059202	0.00396957	0.00041745	16,109	0.00816816	0.05101536	16,826
215		0.00003861	828	0.00066297	0.00448668	0.00048345	18,638	0.00904365	0.05681280	19,466
216		0.00003267	713	0.00056595	0.00397947	0.00041184	16,034	0.00789888	0.05255019	16,747
217		0.00003399	746	0.00055902	0.00413226	0.00042768	16,781	0.00785664	0.05378901	17,527
218		0.00003333	740	0.00048873	0.00407682	0.00042009	16,654	0.00695640	0.05419656	17,394
219		0.00003300	738	0.00043296	0.00408177	0.00041283	16,577	0.00563079	0.05195157	17,314
220		0.00004686	1,056	0.00059103	0.00496221	0.00058047	23,758	0.00755601	0.06416091	24,814

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
221	Non-Responsive	0.00004125	928	0.00052734	0.00474969	0.00051645	20,877	0.00670494	0.06005802	21,805
222		0.00003960	890	0.00051018	0.00458964	0.00049698	20,002	0.00680361	0.05791500	20,892
223		0.00004785	1,064	0.00067782	0.00501699	0.00059433	23,972	0.00958617	0.06435462	25,036
224		0.00004785	1,054	0.00076098	0.00500940	0.00059532	23,752	0.01058607	0.06328179	24,806
225		0.00004719	1,019	0.00079662	0.00501369	0.00058773	22,974	0.01097514	0.06368076	23,993
226		0.00004785	1,023	0.00079563	0.00493086	0.00059466	23,081	0.01078077	0.06504069	24,104
227		0.00004884	1,053	0.00071181	0.00518463	0.00060588	23,762	0.00940698	0.06115065	24,815
228		0.00005511	1,186	0.00068838	0.00529683	0.00067584	26,780	0.00894300	0.06509481	27,965
229		0.00004455	948	0.00071016	0.00494340	0.00055374	21,384	0.00955548	0.06160836	22,332
230		0.00005181	1,113	0.00070686	0.00529254	0.00063888	25,150	0.00925716	0.06258318	26,263
231		0.00001881	459	0.00029205	0.00317361	0.00024090	10,302	0.00377850	0.04214595	10,761
232		0.00002244	574	0.00033132	0.00363858	0.00028413	12,864	0.00445335	0.04791270	13,438
233		0.00002211	563	0.00033891	0.00362934	0.00028215	12,617	0.00449427	0.04783449	13,180
234		0.00002211	552	0.00036135	0.00339834	0.00028083	12,415	0.00478599	0.04508625	12,967
235		0.00002211	545	0.00036927	0.00353760	0.00028050	12,260	0.00485463	0.04658181	12,805
236		0.00002211	543	0.00035871	0.00352869	0.00028116	12,207	0.00466653	0.04631253	12,750
237		0.00002211	535	0.00033396	0.00352374	0.00028017	12,009	0.00429198	0.04640922	12,543
238		0.00002343	562	0.00034947	0.00362604	0.00029865	12,628	0.00458304	0.04730121	13,190
239		0.00006600	1,495	0.00081378	0.00682605	0.00081015	33,775	0.00982839	0.08567724	35,269
240		0.00006996	1,634	0.00097713	0.00578688	0.00085371	37,018	0.01226511	0.08080611	38,652
241		0.00006897	1,676	0.00094842	0.00547173	0.00083457	37,955	0.01209021	0.06952572	39,631
242		0.00006699	1,705	0.00078969	0.00512061	0.00080883	38,404	0.00979374	0.06207465	40,109
243		0.00008415	2,016	0.00113619	0.00604263	0.00100287	45,780	0.01422399	0.07655274	47,796
244		0.00002871	659	0.00037554	0.00423456	0.00036003	14,787	0.00506385	0.05280693	15,446
245		0.00003003	693	0.00039204	0.00419265	0.00037884	15,535	0.00525393	0.05368506	16,228
246		0.00003168	726	0.00041118	0.00427812	0.00039864	16,282	0.00548988	0.05424705	17,007
247		0.00003366	765	0.00043032	0.00432927	0.00042141	17,173	0.00566544	0.05476416	17,938
248		0.00003564	811	0.00045870	0.00444939	0.00044781	18,232	0.00583011	0.05579772	19,043
249		0.00002046	476	0.00031152	0.00411510	0.00026004	10,680	0.00400785	0.05232051	11,157
250		0.00002145	499	0.00032109	0.00419958	0.00027258	11,189	0.00411444	0.05293530	11,688
251		0.00002244	520	0.00033066	0.00427581	0.00028446	11,662	0.00422037	0.05336397	12,183
252		0.00002343	543	0.00033693	0.00419826	0.00029469	12,167	0.00426789	0.05131005	12,710
253		0.00002409	558	0.00033858	0.00423192	0.00030327	12,498	0.00436755	0.05124273	13,056
254		0.00003663	834	0.00048543	0.00407352	0.00043956	18,687	0.00578391	0.04877466	19,521
255		0.00003564	803	0.00047916	0.00404217	0.00042669	17,990	0.00574596	0.04936866	18,793
256		0.00003432	775	0.00047058	0.00390423	0.00041481	17,365	0.00569382	0.04782525	18,139
257		0.00003333	747	0.00045804	0.00382008	0.00040260	16,753	0.00559251	0.04761042	17,500
258		0.00003234	721	0.00044286	0.00361185	0.00039105	16,177	0.00544566	0.04571556	16,898

HOUSENO	STREET	PIN	NAME	ZIP	X COORD	Y COORD	ELEVATION (M)
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
259	Non-Responsive	0.00004026	987	0.00061842	0.00339471	0.00048081	21,984	0.00783981	0.04386195	22,971
260		0.00003003	666	0.00039204	0.00370458	0.00036828	14,957	0.00476487	0.04591026	15,623
261		0.00003102	689	0.00041745	0.00360195	0.00037653	15,462	0.00519486	0.04387977	16,151
262		0.00003597	786	0.00044352	0.00435732	0.00043890	17,670	0.00530046	0.05477109	18,456
263		0.00003102	666	0.00040128	0.00420915	0.00038346	14,985	0.00500445	0.05493873	15,651
264		0.00003201	681	0.00040920	0.00387057	0.00039600	15,317	0.00523182	0.05126088	15,998
265		0.00003465	748	0.00042900	0.00449955	0.00042570	16,836	0.00524502	0.05732133	17,584
266		0.00003498	751	0.00044649	0.00404844	0.00043560	16,899	0.00570405	0.05315838	17,650
267		0.00003465	734	0.00042240	0.00427581	0.00043032	16,539	0.00561627	0.05241489	17,273
268		0.00003366	712	0.00048906	0.00453354	0.00042009	16,042	0.00656337	0.05697780	16,754
269		0.00003333	708	0.00053460	0.00445929	0.00041811	15,953	0.00723294	0.05694810	16,661
270		0.00003894	839	0.00047322	0.00426921	0.00048312	18,893	0.00610698	0.05150277	19,732
271		0.00003696	789	0.00050292	0.00469623	0.00046299	17,778	0.00670296	0.05768565	18,567
272		0.00004587	994	0.00057222	0.00468633	0.00056133	22,404	0.00712734	0.05805558	23,398
273		0.00004257	921	0.00052470	0.00415998	0.00052602	20,744	0.00668349	0.05253666	21,665
274		0.00005148	1,131	0.00060885	0.00520146	0.00062304	25,457	0.00735042	0.06053058	26,588
275		0.00004917	1,070	0.00060324	0.00509355	0.00059631	24,110	0.00731412	0.06100710	25,181
276		0.00004521	991	0.00053526	0.00492822	0.00054879	22,281	0.00650331	0.05899707	23,272
277		0.00004389	966	0.00052668	0.00477114	0.00053097	21,725	0.00618948	0.05732133	22,690
278		0.00004257	940	0.00051678	0.00451704	0.00051216	21,095	0.00604395	0.05353854	22,035
279		0.00004323	963	0.00055143	0.00412764	0.00052008	21,618	0.00664224	0.05030883	22,581
280		0.00004125	917	0.00051447	0.00421377	0.00049962	20,602	0.00628386	0.04930728	21,519
281		0.00003927	873	0.00047586	0.00413292	0.00047487	19,602	0.00570867	0.04846314	20,475
282		0.00003762	835	0.00047256	0.00426030	0.00045771	18,735	0.00559812	0.05162619	19,570
283		0.00006864	1,499	0.00079827	0.00561297	0.00081609	33,852	0.00951258	0.06071769	35,351
284		0.00008085	1,792	0.00084282	0.00558657	0.00094446	40,455	0.01057221	0.06191790	42,247
285		0.00007623	1,675	0.00083820	0.00569316	0.00089793	37,846	0.01039434	0.06176841	39,521
286		0.00007062	1,534	0.00083853	0.00527538	0.00084645	34,690	0.01018842	0.06494499	36,223
287		0.00007755	1,679	0.00090156	0.00585750	0.00092631	38,024	0.01103916	0.07220895	39,703
288		0.00007887	1,693	0.00091806	0.00626109	0.00094677	38,402	0.01157343	0.07680816	40,095
289		0.00007887	1,688	0.00109461	0.00642906	0.00095271	38,295	0.01407879	0.07969401	39,983
290		0.00007326	1,576	0.00114906	0.00604263	0.00089133	35,684	0.01535589	0.07756485	37,260
291		0.00007161	1,562	0.00107877	0.00627066	0.00087681	35,367	0.01483360	0.07971117	36,929
292		0.00008745	1,866	0.00129228	0.00685872	0.00105171	42,370	0.01681779	0.08433678	44,236
293		0.00012111	2,566	0.00146586	0.00796323	0.00141405	58,723	0.01782825	0.10074702	61,289
294		0.00011913	2,555	0.00130119	0.00747912	0.00137346	58,388	0.01523115	0.09204657	60,944
295		0.00012045	2,570	0.00127644	0.00772794	0.00139689	58,762	0.01548756	0.09800406	61,332
296		0.00011616	2,515	0.00125730	0.00647922	0.00132825	57,337	0.01491765	0.07672764	59,852

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
297	Non-Responsive	0.00011055	2,428	0.00112497	0.00597927	0.00125664	55,151	0.01388211	0.06738633	57,579
298		0.00010461	2,327	0.00101640	0.00583605	0.00118635	52,716	0.01213509	0.06527532	55,043
299		0.00001914	448	0.00029403	0.00396429	0.00024387	10,039	0.00379731	0.05094342	10,486
300		0.00002112	487	0.00030360	0.00375210	0.00026928	10,906	0.00414546	0.04608450	11,393
301		0.00002277	518	0.00032043	0.00370524	0.00028743	11,597	0.00435039	0.04521594	12,115
302		0.00002409	550	0.00033165	0.00350823	0.00030393	12,318	0.00446226	0.04528590	12,868
303		0.00002244	513	0.00031449	0.00327393	0.00028545	11,476	0.00422301	0.04266405	11,989
304		0.00002277	514	0.00031614	0.00323433	0.00028875	11,518	0.00413952	0.04240434	12,032
305		0.00002574	569	0.00041943	0.00345081	0.00032637	12,779	0.00592911	0.04598088	13,348
306		0.00002475	545	0.00038643	0.00333267	0.00031152	12,223	0.00547371	0.04471269	12,768
307		0.00002343	520	0.00035541	0.00319671	0.00029700	11,676	0.00505428	0.04316565	12,196
308		0.00002244	499	0.00033066	0.00307230	0.00028413	11,203	0.00466818	0.04136814	11,702
309		0.00002112	474	0.00031383	0.00298848	0.00026928	10,615	0.00416757	0.03949077	11,089
310		0.00002838	675	0.00041976	0.00413490	0.00035706	15,157	0.00543378	0.05094276	15,832
311		0.00003003	722	0.00044451	0.00402072	0.00037917	16,224	0.00577566	0.05022435	16,946
312		0.00003432	816	0.00050127	0.00438867	0.00042999	18,335	0.00644556	0.05427576	19,151
313		0.00003201	766	0.00046926	0.00416196	0.00040227	17,222	0.00607134	0.05198490	17,988
314		0.00002838	685	0.00041019	0.00391281	0.00035739	15,420	0.00537702	0.05012535	16,106
315		0.00003069	754	0.00044187	0.00422268	0.00038808	16,984	0.00587796	0.05378274	17,739
316		0.00003069	764	0.00046992	0.00423819	0.00038775	17,171	0.00597861	0.05401440	17,934
317		0.00003069	776	0.00047058	0.00403689	0.00038808	17,412	0.00607068	0.05163048	18,188
318		0.00003333	857	0.00044418	0.00442464	0.00041844	19,174	0.00572319	0.05614521	20,031
319		0.00003003	776	0.00040887	0.00420684	0.00037983	17,369	0.00529848	0.05409492	18,144
320		0.00002838	727	0.00038841	0.00406923	0.00035673	16,293	0.00505329	0.05266602	17,020
321		0.00004323	1,119	0.00055374	0.00500478	0.00053856	25,043	0.00719301	0.06024051	26,162
322		0.00004257	1,081	0.00057057	0.00492954	0.00052965	24,249	0.00721908	0.05834466	25,330
323		0.00004224	1,062	0.00059961	0.00471372	0.00052833	23,877	0.00749232	0.05901423	24,939
324		0.00004257	1,047	0.00058443	0.00494109	0.00052932	23,594	0.00778569	0.05972472	24,640
325		0.00004257	1,029	0.00059928	0.00485826	0.00053031	23,176	0.00780021	0.05728899	24,205
326		0.00003828	906	0.00056826	0.00468534	0.00047883	20,402	0.00728871	0.05687352	21,308
327		0.00004719	1,104	0.00067221	0.00532488	0.00058773	24,853	0.00841764	0.06899145	25,957
328		0.00004158	982	0.00061017	0.00488268	0.00052107	22,121	0.00775797	0.06197136	23,103
329		0.00003300	712	0.00042438	0.00437679	0.00040788	15,996	0.00526251	0.05665836	16,708
330		0.00002112	508	0.00031350	0.00338877	0.00026895	11,431	0.00415140	0.04487670	11,939
331		0.00009702	2,156	0.00114378	0.00808071	0.00115632	49,116	0.01363989	0.09709161	51,272
332		0.00010329	2,312	0.00108735	0.00598851	0.00116820	52,201	0.01226247	0.06829119	54,513
333		0.00009075	2,031	0.00088968	0.00548394	0.00103686	45,845	0.01084050	0.06048042	47,876
334		0.00006699	2,372	0.00057486	0.00420585	0.00086097	54,125	0.00754644	0.05106420	56,498



HOUSENO	STREET	PIN	NAME	ZIP	X COORD	Y COORD	ELEVATION
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# Non-Responsive

HOUSENO	STREET	POST-BAGHOUSE CASE			PRE-BAGHOUSE CASE			Total		
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
335	Non-Responsive		959	0.00043527	0.00464013	0.00044220	21,338	0.00577896	0.05863473	22,297
336			1,682	0.00058410	0.00416625	0.00066330	38,048	0.00788832	0.04838922	39,730
337			1,176	0.00054813	0.00472791	0.00055011	26,092	0.00710985	0.06150045	27,269
338			3,646	0.00088539	0.00479523	0.00135663	83,564	0.01137972	0.05730912	87,210
339			1,009	0.00044814	0.00325182	0.00035310	22,784	0.00614394	0.04294917	23,792
340			1,426	0.00038346	0.00356895	0.00048675	32,335	0.00494043	0.04577001	33,761
341			1,074	0.00044451	0.00318252	0.00037488	24,267	0.00607233	0.04338708	25,341
342			956	0.00044979	0.00332937	0.00033561	21,594	0.00615846	0.04389396	22,550
343			905	0.00044550	0.00334092	0.00031845	20,426	0.00612051	0.04427016	21,331
344			859	0.00043890	0.00331419	0.00030261	19,368	0.00604527	0.04409922	20,227
345			817	0.00042999	0.00325314	0.00028842	18,426	0.00593043	0.04343295	19,243
346			1,519	0.00039336	0.00374913	0.00051777	34,474	0.00522555	0.04706295	35,993
347			1,258	0.00041349	0.00336072	0.00043626	28,453	0.00558558	0.04529019	29,711
348			1,332	0.00039468	0.00333597	0.00046134	30,136	0.00530211	0.04455726	31,467
349			1,427	0.00042075	0.00363528	0.00049632	32,322	0.00516087	0.04665606	33,748
350			1,538	0.00044979	0.00372207	0.00053394	34,876	0.00548361	0.04806846	36,414
351			1,662	0.00047850	0.00370854	0.00057651	37,725	0.00579876	0.04805460	39,387
352			1,790	0.00050424	0.00378906	0.00062106	40,679	0.00607233	0.04989897	42,469
353			986	0.00030690	0.00309045	0.00033759	22,281	0.00380457	0.03965478	23,267
354			845	0.00029304	0.00265188	0.00028974	19,063	0.00402567	0.03422793	19,908
355			2,141	0.00052239	0.00429957	0.00074910	48,777	0.00687819	0.05357286	50,918
356			2,189	0.00055473	0.00453981	0.00076296	49,868	0.00738606	0.05521461	52,058
357			1,186	0.00033726	0.00330891	0.00040491	26,880	0.00422763	0.04346859	28,066
358			1,017	0.00028809	0.00308517	0.00034386	23,021	0.00368940	0.04059726	24,038
359			1,023	0.00049962	0.00479061	0.00046827	22,825	0.00666435	0.06119817	23,848
360			1,321	0.00074910	0.00443256	0.00058938	29,567	0.01017489	0.06061440	30,888
361			5,101	0.00242385	0.01049169	0.00238161	115,866	0.02604756	0.10397640	120,967
362			7,405	0.00240735	0.00924066	0.00324786	170,456	0.02683395	0.11742819	177,861
363			9,569	0.00370788	0.01326633	0.00314589	237,935	0.04127739	0.10957485	247,504
364			1,595	0.00072006	0.00456984	0.00067518	36,054	0.00951489	0.05750811	37,649
365			1,493	0.00067386	0.00444939	0.00063030	33,715	0.00893343	0.05545815	35,209
366			1,399	0.00060984	0.00433125	0.00058344	31,587	0.00796818	0.05453679	32,986
367			1,358	0.00066132	0.00450384	0.00057651	30,587	0.00917235	0.05804271	31,945
368			1,161	0.00051810	0.00396693	0.00048609	26,140	0.00692703	0.05097477	27,301
369			1,088	0.00048378	0.00383328	0.00045441	24,479	0.00647196	0.04960857	25,567
370			1,051	0.00057321	0.00432696	0.00044748	23,598	0.00797610	0.05735367	24,649
371			988	0.00054087	0.00411972	0.00042009	22,172	0.00753720	0.05489583	23,160
372			1,208	0.00065340	0.00482526	0.00051711	27,142	0.00906411	0.06327849	28,350

HOUSENO	STREET	PIN	NAME	ZIP	X COORD	Y COORD	ELEVATION (M)
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Non-Responsive

HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
373	Non-Responsive	0.00004356	1,285	0.00069201	0.00505131	0.00055143	28,888	0.00958089	0.06578583	30,174
374		0.00004653	1,364	0.00073161	0.00527505	0.00058806	30,686	0.01012341	0.06811200	32,050
375		0.00016137	5,677	0.00116358	0.00478104	0.00198957	131,700	0.01434576	0.06980919	137,377
376		0.00013926	4,874	0.00112431	0.00505659	0.00174339	112,569	0.01435071	0.06395169	117,443
377		0.00012045	4,251	0.00098670	0.00505131	0.00151404	97,733	0.01286934	0.06152190	101,983
378		0.00010428	3,702	0.00088704	0.00474276	0.00131637	84,748	0.01102596	0.05637159	88,450
379		0.00009207	3,267	0.00080850	0.00476124	0.00116292	74,547	0.00948552	0.05370948	77,814
380		0.00008184	2,907	0.00072831	0.00500016	0.00103752	66,231	0.00878889	0.06118101	69,138
381		0.00008646	2,880	0.00109791	0.00615120	0.00108504	65,417	0.01402038	0.07643229	68,297
382		0.00009570	3,190	0.00116226	0.00623832	0.00119757	72,559	0.01453122	0.07774734	75,749
383		0.00010560	3,520	0.00120483	0.00610401	0.00131472	80,192	0.01464441	0.08071206	83,712
384		0.00011715	3,912	0.00124146	0.00618849	0.00144936	89,322	0.01494042	0.08243862	93,234
385		0.00013233	4,437	0.00132000	0.00631851	0.00162129	101,734	0.01626108	0.08188455	106,172
386		0.00014883	5,050	0.00135993	0.00647295	0.00180675	116,384	0.01688742	0.08348241	121,435
387		0.00009273	2,728	0.00117414	0.00551430	0.00116325	62,132	0.01482558	0.07211820	64,860
388		0.00008514	2,491	0.00109659	0.00556578	0.00107547	56,685	0.01399728	0.07354908	59,177
389		0.00007821	2,298	0.00101376	0.00536217	0.00098736	52,183	0.01297032	0.07030551	54,480
390		0.00007161	2,123	0.00093720	0.00515097	0.00090816	48,173	0.01205094	0.06700782	50,296
391		0.00006600	1,969	0.00086889	0.00494373	0.00083820	44,598	0.01124178	0.06401571	46,566
392		0.00006138	1,833	0.00080982	0.00481635	0.00077847	41,507	0.01053162	0.06195750	43,340
393		0.00005709	1,705	0.00076857	0.00468336	0.00072336	38,557	0.01012308	0.05951946	40,261
394		0.00005049	1,480	0.00079002	0.00550935	0.00063954	33,314	0.01090254	0.07050120	34,794
395		0.00004851	1,422	0.00075999	0.00541101	0.00061446	32,007	0.01050588	0.06946137	33,429
396		0.00005346	1,560	0.00082830	0.00568656	0.00067683	35,123	0.01142592	0.07208355	36,683
397		0.00005709	1,653	0.00087186	0.00585420	0.00071940	37,218	0.01200408	0.07336131	38,871
398		0.00006171	1,772	0.00092796	0.00601491	0.00077550	39,954	0.01273998	0.07417542	41,727
399		0.00006633	1,895	0.00098208	0.00612051	0.00083292	42,728	0.01344288	0.07412493	44,623
400		0.00007062	2,004	0.00105336	0.00616044	0.00088605	45,221	0.01406922	0.07481034	47,225
401		0.00007557	2,144	0.00114840	0.00577368	0.00093885	48,362	0.01495296	0.07318872	50,506
402		0.00018942	5,321	0.00217767	0.00659769	0.00227931	124,037	0.02598420	0.08339133	129,358
403		0.00016401	4,638	0.00192984	0.00646074	0.00199947	107,326	0.02338083	0.08113809	111,964
404		0.00014520	4,137	0.00174141	0.00636867	0.00178497	95,272	0.02133417	0.08011641	99,408
405		0.00012870	3,696	0.00157113	0.00621390	0.00159192	84,801	0.01943172	0.07830603	88,497
406		0.00011484	3,324	0.00142362	0.00600765	0.00142725	76,032	0.01773816	0.07624914	79,356
407		0.00010296	3,003	0.00128799	0.00576873	0.00128502	68,512	0.01616736	0.07446153	71,515
408		0.00008250	2,320	0.00130317	0.00580668	0.00102168	52,347	0.01691481	0.08051472	54,667
409		0.00008943	2,488	0.00145464	0.00626967	0.00110187	56,157	0.01877007	0.08607093	58,644
410		0.00009735	2,683	0.00161502	0.00663168	0.00119361	60,576	0.02064942	0.08961744	63,259

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
411	Non-Responsive	0.00010593	2,880	0.00176253	0.00693693	0.00128700	65,083	0.02223606	0.09085230	67,962
412		0.00011517	3,102	0.00189321	0.00693990	0.00138963	70,191	0.02336433	0.08795853	73,293
413		0.00012639	3,364	0.00199188	0.00645216	0.00150513	76,321	0.02367915	0.07721010	79,685
414		0.00019074	3,679	0.00239250	0.01112991	0.00208923	85,114	0.02852421	0.13083213	88,793
415		0.00017754	3,528	0.00232848	0.01054383	0.00200442	81,570	0.02915583	0.13203828	85,098
416		0.00016962	3,424	0.00243078	0.01058871	0.00195228	79,196	0.03121899	0.13649757	82,620
417		0.00015972	3,290	0.00232914	0.01041678	0.00186978	76,141	0.03090054	0.13739088	79,430
418		0.00013827	2,959	0.00189717	0.00889119	0.00166155	68,668	0.02586408	0.12415128	71,628
419		0.00009735	2,330	0.00152328	0.00850245	0.00114972	52,417	0.01912581	0.11223300	54,746
420		0.00009966	2,394	0.00143715	0.00929907	0.00116160	53,545	0.01757316	0.11509047	55,939
421		0.00010329	2,492	0.00135960	0.00890109	0.00118668	55,509	0.01714812	0.11390478	58,002
422		0.00004653	1,361	0.00068310	0.00620499	0.00055968	29,728	0.00954525	0.08012004	31,089
423		0.00005016	1,317	0.00079794	0.00645150	0.00062337	29,587	0.01050753	0.08425230	30,905
424		0.00004818	1,246	0.00070455	0.00630762	0.00060291	28,173	0.00940533	0.07867431	29,420
425		0.00004587	1,183	0.00069234	0.00555258	0.00058113	26,871	0.00946275	0.07488789	28,054
426		0.00004356	1,111	0.00068211	0.00556809	0.00055308	25,289	0.00882354	0.07754604	26,399
427		0.00004026	1,023	0.00078507	0.00562650	0.00051480	23,360	0.01024485	0.07524693	24,383
428		0.00003630	927	0.00077484	0.00563244	0.00046728	21,188	0.01053459	0.06987783	22,115
429		0.00003300	851	0.00068013	0.00538659	0.00042702	19,457	0.00946242	0.06963033	20,308
430		0.00003036	794	0.00056859	0.00476487	0.00039567	18,135	0.00806883	0.06512583	18,928
431		0.00002838	745	0.00051909	0.00499224	0.00036795	16,994	0.00700425	0.05824467	17,739
432		0.00002673	708	0.00050457	0.00518001	0.00034617	16,103	0.00677655	0.05912676	16,811
433		0.00002475	666	0.00047619	0.00514338	0.00032241	15,127	0.00646536	0.05986596	15,794
434		0.00002277	623	0.00042768	0.00456654	0.00029502	14,102	0.00584727	0.05601783	14,724
435		0.00002145	595	0.00039930	0.00413523	0.00027852	13,442	0.00542223	0.05405763	14,037
436		0.00002046	571	0.00037851	0.00413160	0.00026532	12,906	0.00511929	0.05273796	13,477
437		0.00001947	549	0.00037092	0.00405405	0.00025212	12,385	0.00501732	0.05261289	12,934
438		0.00001848	529	0.00037785	0.00385473	0.00024024	11,900	0.00504636	0.05074113	12,428
439		0.00001782	511	0.00039402	0.00358050	0.00022968	11,482	0.00501732	0.04766916	11,993
440		0.00001584	442	0.00032670	0.00410916	0.00020724	10,011	0.00453057	0.05211492	10,453
441		0.00001683	466	0.00035475	0.00441309	0.00022077	10,573	0.00488961	0.05476812	11,039
442		0.00001848	501	0.00038742	0.00468864	0.00024189	11,403	0.00530145	0.05700090	11,904
443		0.00001980	535	0.00040293	0.00449757	0.00026004	12,169	0.00546744	0.05285016	12,704
444		0.00002112	562	0.00040953	0.00416394	0.00027555	12,826	0.00583935	0.05265579	13,388
445		0.00002277	600	0.00049005	0.00442332	0.00029601	13,708	0.00690690	0.05925150	14,307
446		0.00002508	658	0.00058014	0.00478005	0.00032604	15,034	0.00798303	0.06207432	15,692
447		0.00002739	713	0.00061017	0.00475068	0.00035244	16,260	0.00818730	0.06158889	16,973
448		0.00002937	765	0.00058080	0.00473781	0.00037554	17,420	0.00755799	0.06176148	18,185

HOUSENO	STREET	PIN	NAME	ZIP	X COORD	Y COORD	ELEVATION (M)
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
449	Non-Responsive	0.00003168	834	0.00047784	0.00482163	0.00040227	18,911	0.00653631	0.06097410	19,745
450		0.00003399	908	0.00050193	0.00536415	0.00042669	20,457	0.00682935	0.06970656	21,365
451		0.00003531	961	0.00056826	0.00554895	0.00044055	21,499	0.00750717	0.07035501	22,460
452		0.00009603	2,258	0.00141966	0.00852027	0.00116919	51,395	0.01841037	0.11397309	53,653
453		0.00008877	2,066	0.00128865	0.00791175	0.00110286	47,453	0.01718541	0.10834395	49,519
454		0.00007755	1,910	0.00118800	0.00728739	0.00095535	43,394	0.01517307	0.09678471	45,304
455		0.00006963	1,764	0.00109230	0.00687489	0.00086163	39,836	0.01449195	0.09452058	41,600
456		0.00006402	1,656	0.00105798	0.00626835	0.00079266	37,262	0.01381215	0.08078961	38,918
457		0.00005874	1,560	0.00110715	0.00626274	0.00073095	34,991	0.01360590	0.08045598	36,550
458		0.00005478	1,481	0.00112530	0.00638418	0.00068145	33,163	0.01337622	0.08109387	34,644
459		0.00005214	1,420	0.00114180	0.00646965	0.00065373	31,779	0.01392600	0.08585973	33,199
460		0.00004917	1,354	0.00108636	0.00606837	0.00061479	30,288	0.01337061	0.07863240	31,642
461		0.00004653	1,296	0.00101244	0.00579546	0.00058179	28,967	0.01251954	0.07620063	30,264
462		0.00004389	1,241	0.00092862	0.00533907	0.00055242	27,740	0.01149951	0.07135821	28,981
463		0.00004158	1,188	0.00083820	0.00506088	0.00052470	26,536	0.01038213	0.06510537	27,724
464		0.00003927	1,131	0.00076857	0.00468435	0.00049170	25,251	0.00994191	0.06062958	26,382
465		0.00003729	1,083	0.00076230	0.00444345	0.00046893	24,184	0.00997227	0.05830242	25,267
466		0.00003564	1,042	0.00075240	0.00436227	0.00044913	23,247	0.00993069	0.05515191	24,289
467		0.00003399	1,000	0.00074151	0.00420948	0.00042966	22,334	0.00985611	0.05355240	23,335
468		0.00003267	962	0.00072303	0.00406725	0.00041217	21,487	0.00966801	0.05304255	22,449
469		0.00003135	922	0.00070026	0.00409662	0.00039402	20,598	0.00941028	0.05172849	21,520
470		0.00003003	887	0.00067584	0.00407451	0.00037818	19,828	0.00911691	0.05193474	20,715
471		0.00002376	703	0.00057651	0.00394548	0.00030426	15,733	0.00724383	0.05181429	16,436
472		0.00002475	727	0.00061215	0.00423720	0.00031614	16,266	0.00768471	0.05575944	16,993
473		0.00002574	753	0.00064449	0.00458634	0.00032967	16,858	0.00807477	0.05960460	17,611
474		0.00002706	782	0.00066990	0.00485100	0.00034452	17,497	0.00835659	0.06205287	18,279
475		0.00002838	809	0.00068442	0.00497937	0.00036003	18,137	0.00848430	0.06258846	18,946
476		0.00002970	842	0.00068640	0.00495858	0.00037884	18,891	0.00843942	0.06360453	19,733
477		0.00003135	879	0.00067485	0.00483054	0.00040029	19,733	0.00827805	0.06415827	20,612
478		0.00003333	920	0.00064713	0.00488301	0.00042471	20,691	0.00840345	0.06348309	21,611
479		0.00003564	966	0.00063294	0.00512589	0.00045243	21,752	0.00838431	0.06661248	22,718
480		0.00003795	1,018	0.00065967	0.00541596	0.00048444	22,990	0.00870408	0.07166577	24,008
481		0.00004092	1,080	0.00071181	0.00574464	0.00052239	24,459	0.00943833	0.07457505	25,539
482		0.00004455	1,157	0.00076857	0.00567369	0.00056892	26,290	0.01020030	0.07554195	27,448
483		0.00005115	1,295	0.00083490	0.00570471	0.00065175	29,591	0.01095633	0.07870269	30,886
484		0.00005907	1,468	0.00102201	0.00648747	0.00075273	33,688	0.01371084	0.08415033	35,156
485		0.00006534	1,599	0.00111771	0.00681351	0.00082566	36,707	0.01438635	0.09094866	38,306
486		0.00007392	1,768	0.00111012	0.00745635	0.00093159	40,560	0.01440120	0.10351275	42,328



<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
487	<h1>Non-Responsive</h1>						
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
487	Non-Responsive	0.00002706	802	0.00061050	0.00396033	0.00034221	17,927	0.00831567	0.05219214	18,729
488		0.00002574	769	0.00057783	0.00380391	0.00032736	17,192	0.00787677	0.05050122	17,961
489		0.00002475	740	0.00054615	0.00363858	0.00031449	16,557	0.00745602	0.04860009	17,297
490		0.00002376	712	0.00051546	0.00353430	0.00030195	15,919	0.00703692	0.04677717	16,631
491		0.00002277	685	0.00048576	0.00342903	0.00029007	15,321	0.00662937	0.04564395	16,007
492		0.00002211	661	0.00045672	0.00331353	0.00027918	14,779	0.00622974	0.04433055	15,439
493		0.00001782	533	0.00042240	0.00360624	0.00022539	11,900	0.00570669	0.04562910	12,433
494		0.00001848	556	0.00043032	0.00382965	0.00023595	12,421	0.00578655	0.04775562	12,977
495		0.00001947	583	0.00043725	0.00402138	0.00024816	13,036	0.00583308	0.04916604	13,620
496		0.00002013	605	0.00044022	0.00410388	0.00025740	13,494	0.00583440	0.04933401	14,098
497		0.00002079	625	0.00044187	0.00412929	0.00026697	13,959	0.00581922	0.04869777	14,584
498		0.00001584	469	0.00041250	0.00365442	0.00020658	10,540	0.00519288	0.04789092	11,009
499		0.00001551	454	0.00041019	0.00361647	0.00019833	10,185	0.00519024	0.04794174	10,639
500		0.00001485	438	0.00040161	0.00348843	0.00019041	9,837	0.00509949	0.04671777	10,275
501		0.00001419	424	0.00038742	0.00327690	0.00018249	9,492	0.00492426	0.04428303	9,916
502		0.00001353	410	0.00036828	0.00304788	0.00017556	9,173	0.00468930	0.04104573	9,583
503		0.00001155	343	0.00029733	0.00286737	0.00015114	7,716	0.00375177	0.03785925	8,059
504		0.00001188	353	0.00029172	0.00278850	0.00015642	7,928	0.00366102	0.03698013	8,281
505		0.00001254	362	0.00028314	0.00294459	0.00016203	8,166	0.00365640	0.03993462	8,528
506		0.00001287	374	0.00027159	0.00314787	0.00016863	8,425	0.00367092	0.04236507	8,799
507		0.00001353	385	0.00026730	0.00329208	0.00017490	8,686	0.00365508	0.04394808	9,071
508		0.00001419	399	0.00026565	0.00339141	0.00018315	9,023	0.00364617	0.04477143	9,422
509		0.00007392	2,633	0.00070620	0.00521499	0.00094182	59,859	0.00903606	0.06571884	62,492
510		0.00006765	2,408	0.00074547	0.00519618	0.00086361	54,692	0.00956043	0.06679794	57,100
511		0.00006237	2,212	0.00077748	0.00508497	0.00079497	50,169	0.01008315	0.06608844	52,381
512		0.00005742	2,034	0.00079002	0.00499191	0.00073326	46,104	0.01037124	0.06573996	48,138
513		0.00005280	1,876	0.00078804	0.00504504	0.00067749	42,511	0.01044912	0.06348276	44,386
514		0.00004917	1,742	0.00077484	0.00499059	0.00063030	39,434	0.01035111	0.06215847	41,175
515		0.00004587	1,623	0.00075372	0.00485001	0.00058872	36,743	0.01012869	0.06111996	38,366
516		0.00004290	1,515	0.00072963	0.00464541	0.00055044	34,258	0.00982080	0.05908353	35,773
517		0.00004026	1,420	0.00069762	0.00438669	0.00051678	32,122	0.00942744	0.05620725	33,541
518		0.00003696	1,301	0.00065307	0.00433587	0.00047487	29,379	0.00886314	0.05570796	30,680
519		0.00004092	1,358	0.00048642	0.00423522	0.00052206	30,654	0.00666864	0.05418105	32,012
520		0.00004422	1,471	0.00054120	0.00440946	0.00056529	33,238	0.00740487	0.05540040	34,709
521		0.00004719	1,569	0.00059037	0.00459030	0.00060225	35,492	0.00802890	0.05716524	37,061
522		0.00005049	1,676	0.00064383	0.00476322	0.00064350	37,925	0.00873774	0.05865948	39,601
523		0.00005379	1,793	0.00070224	0.00490611	0.00068772	40,564	0.00948618	0.06016725	42,357
524		0.00005808	1,927	0.00076461	0.00501600	0.00073854	43,635	0.01029138	0.06267162	45,562

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
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HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
525	Non-Responsive	0.00006237	2,077	0.00083457	0.00508530	0.00079596	47,057	0.01118568	0.06579936	49,133
526		0.00006765	2,247	0.00091344	0.00543543	0.00086130	50,963	0.01213872	0.07130112	53,210
527		0.00007227	2,415	0.00095337	0.00556413	0.00091344	54,769	0.01248258	0.07144203	57,184
528		0.00007887	2,634	0.00102828	0.00591360	0.00099462	59,760	0.01332243	0.07492221	62,394
529		0.00003102	1,091	0.00054549	0.00402435	0.00040062	24,603	0.00747615	0.05266767	25,694
530		0.00002904	1,015	0.00050127	0.00381282	0.00037356	22,877	0.00688380	0.05016792	23,891
531		0.00002673	935	0.00045276	0.00353826	0.00034485	21,055	0.00622677	0.04677024	21,990
532		0.00002475	865	0.00041151	0.00327525	0.00032043	19,469	0.00566907	0.04343361	20,334
533		0.00002376	826	0.00038412	0.00320496	0.00030558	18,566	0.00529716	0.04246737	19,392
534		0.00002607	864	0.00033990	0.00351219	0.00033594	19,446	0.00430287	0.04708308	20,309
535		0.00002739	905	0.00035046	0.00362604	0.00035211	20,394	0.00441441	0.04849779	21,299
536		0.00002871	954	0.00036135	0.00374484	0.00037092	21,511	0.00453057	0.04995309	22,465
537		0.00003036	1,007	0.00037323	0.00386760	0.00039105	22,703	0.00464838	0.05142357	23,710
538		0.00003201	1,060	0.00038379	0.00397848	0.00041118	23,895	0.00486321	0.05271420	24,954
539		0.00003399	1,131	0.00038907	0.00398970	0.00043526	25,508	0.00524568	0.05218059	26,639
540		0.00003168	973	0.00042768	0.00360063	0.00040491	21,859	0.00571923	0.04711806	22,832
541		0.00003003	925	0.00040788	0.00349734	0.00038478	20,792	0.00544929	0.04595382	21,717
542		0.00002871	881	0.00039039	0.00339735	0.00036630	19,802	0.00521103	0.04480542	20,683
543		0.00002706	816	0.00044781	0.00359106	0.00034485	18,277	0.00625977	0.04806813	19,094
544		0.00002838	852	0.00046728	0.00370623	0.00036036	19,083	0.00652971	0.04945446	19,935
545		0.00002970	895	0.00049005	0.00383328	0.00037884	20,057	0.00684123	0.05096586	20,952
546		0.00003135	942	0.00051513	0.00396792	0.00039930	21,119	0.00718740	0.05252874	22,061
547		0.00035805	12,469	0.00227403	0.00806652	0.00378279	303,110	0.02613930	0.09274485	315,580
548		0.00003663	1,015	0.00063162	0.00545358	0.00045111	22,562	0.00830973	0.06939636	23,577
549		0.00002310	682	0.00053823	0.00390885	0.00029337	15,228	0.00676533	0.04855884	15,910
550		0.00003366	1,028	0.00045210	0.00371613	0.00042834	23,115	0.00603471	0.04839054	24,142
551		0.00007986	1,973	0.00130251	0.00800184	0.00096360	44,350	0.01680954	0.10340154	46,323
552		0.00009702	2,277	0.00146124	0.00883971	0.00117381	51,741	0.01926441	0.12141756	54,019
553		0.00002112	638	0.00042966	0.00319539	0.00026895	14,260	0.00586674	0.04293795	14,898
554		0.00002046	615	0.00040491	0.00307263	0.00025938	13,769	0.00552288	0.04145724	14,384
555		0.00001980	595	0.00038115	0.00296043	0.00025014	13,296	0.00519585	0.03991449	13,891
556		0.00001881	574	0.00035607	0.00286011	0.00024123	12,824	0.00485760	0.03827439	13,398
557		0.00001815	555	0.00033528	0.00277002	0.00023298	12,399	0.00456621	0.03699993	12,954
558		0.00001584	476	0.00038742	0.00283536	0.00019965	10,621	0.00527835	0.03779952	11,097
559		0.00001617	489	0.00039831	0.00303501	0.00020559	10,912	0.00541695	0.03943104	11,401
560		0.00001683	504	0.00040821	0.00323301	0.00021219	11,250	0.00554037	0.04170408	11,754
561		0.00001716	517	0.00041448	0.00342210	0.00021813	11,534	0.00561792	0.04369695	12,050
562		0.00001320	399	0.00035013	0.00294756	0.00017028	8,922	0.00446028	0.03908982	9,321

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X COORD</u>	<u>Y COORD</u>	<u>ELEVATION (M)</u>
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# Non-Responsive

HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
563	Non-Responsive	0.00001287	390	0.00033363	0.00307131	0.00016566	8,708	0.00424116	0.03801501	9,098
564		0.00001122	334	0.00030063	0.00290400	0.00014619	7,512	0.00380886	0.03866478	7,846
565		0.00002277	788	0.00036102	0.00315051	0.00029238	17,711	0.00498762	0.04187205	18,499
566		0.00002178	753	0.00033924	0.00308550	0.00028017	16,939	0.00468732	0.04111536	17,692
567		0.00002079	719	0.00031581	0.00300762	0.00026763	16,157	0.00438306	0.04017288	16,876
568		0.00002277	753	0.00030987	0.00317493	0.00029370	16,949	0.00396660	0.04280133	17,702
569		0.00002376	790	0.00032043	0.00329274	0.00030756	17,774	0.00408705	0.04431075	18,564
570		0.00002508	828	0.00033033	0.00340395	0.00032208	18,640	0.00419859	0.04572447	19,468
571		0.00001980	688	0.00029535	0.00292248	0.00025608	15,446	0.00410322	0.03912579	16,134
572		0.00002079	689	0.00029007	0.00295383	0.00026862	15,484	0.00373725	0.03993396	16,173
573		0.00002178	720	0.00029964	0.00306108	0.00028050	16,179	0.00384879	0.04132425	16,899
574		0.00002343	727	0.00033363	0.00300861	0.00030096	16,305	0.00454443	0.04017882	17,032
575		0.00002244	696	0.00032241	0.00292248	0.00028776	15,594	0.00439989	0.03912150	16,291
576		0.00002145	653	0.00035838	0.00300432	0.00027423	14,601	0.00502029	0.04074642	15,254
577		0.00002244	680	0.00037323	0.00310695	0.00028578	15,198	0.00522555	0.04205025	15,878
578		0.00002739	841	0.00037422	0.00330033	0.00034881	18,881	0.00504339	0.04367550	19,722
579		0.00002607	807	0.00036069	0.00321486	0.00033429	18,095	0.00489522	0.04266207	18,902
580		0.00002475	765	0.00034683	0.00310992	0.00031680	17,167	0.00471537	0.04140213	17,932
581		0.00002343	714	0.00039237	0.00323565	0.00030063	15,971	0.00548988	0.04367286	16,685
582		0.00002475	747	0.00041052	0.00336006	0.00031548	16,743	0.00574596	0.04522617	17,490
583		0.00002607	782	0.00042933	0.00347853	0.00033033	17,521	0.00600600	0.04669533	18,303
584		0.00002112	777	0.00042042	0.00317625	0.00027489	17,519	0.00580569	0.04251489	18,296
585		0.00002046	743	0.00040953	0.00308220	0.00026367	16,741	0.00566643	0.04134174	17,483
586		0.00001947	709	0.00039765	0.00296406	0.00025212	15,983	0.00549780	0.03983265	16,692
587		0.00001122	312	0.00025773	0.00367752	0.00014619	7,077	0.00346038	0.04860768	7,389
588		0.00001155	324	0.00027225	0.00385869	0.00015246	7,340	0.00364650	0.05049264	7,664
589		0.00001221	336	0.00028413	0.00396396	0.00015939	7,627	0.00381150	0.05127441	7,963
590		0.00001287	350	0.00029172	0.00397518	0.00016731	7,971	0.00395835	0.05067051	8,322
591		0.00001221	328	0.00028347	0.00295878	0.00015774	7,457	0.00401511	0.04070715	7,785
592		0.00001155	312	0.00025014	0.00295053	0.00015048	7,124	0.00356631	0.03739263	7,436
593		0.00001518	405	0.00032472	0.00330165	0.00019635	9,227	0.00462000	0.04537038	9,632
594		0.00001617	436	0.00039006	0.00371316	0.00021219	9,942	0.00544830	0.05018574	10,378
595		0.00001716	457	0.00042273	0.00383196	0.00022308	10,439	0.00584727	0.05110974	10,896
596		0.00001815	481	0.00044385	0.00380127	0.00023397	10,955	0.00606804	0.05000193	11,436
597		0.00001881	505	0.00045012	0.00389961	0.00024486	11,486	0.00606309	0.05183376	11,991
598		0.00001980	530	0.00043725	0.00391875	0.00025575	12,038	0.00579183	0.05111238	12,568
599		0.00002079	554	0.00040425	0.00382371	0.00026532	12,559	0.00528330	0.05081637	13,113
600		0.00002145	580	0.00036003	0.00402039	0.00027489	13,135	0.00459228	0.05238651	13,715

<u>HOUSENO</u>	<u>STREET</u>	<u>PIN</u>	<u>NAME</u>	<u>ZIP</u>	<u>X_COORD</u>	<u>Y_COORD</u>	<u>ELEVATION (M)</u>
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# Non-Responsive

HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
601	Non-Responsive	0.00002211	606	0.00033099	0.00398871	0.00028347	13,694	0.00468864	0.05068503	14,300
602		0.00002310	633	0.00034287	0.00422103	0.00029172	14,262	0.00480051	0.05665242	14,895
603		0.00002376	656	0.00036234	0.00452463	0.00029799	14,723	0.00481305	0.05943498	15,379
604		0.00002409	675	0.00038742	0.00455730	0.00030261	15,096	0.00512886	0.05829747	15,770
605		0.00002442	695	0.00041151	0.00428769	0.00030657	15,476	0.00544599	0.05503410	16,171
606		0.00002475	714	0.00043197	0.00455730	0.00030954	15,846	0.00571395	0.05727876	16,560
607		0.00002508	733	0.00044418	0.00521994	0.00031251	16,242	0.00588555	0.06309666	16,975
608		0.00002541	752	0.00045111	0.00554829	0.00031515	16,626	0.00600798	0.06423648	17,378
609		0.00002574	771	0.00044286	0.00538890	0.00031746	17,010	0.00591129	0.06063057	17,781
610		0.00001980	625	0.00035277	0.00431970	0.00024783	13,725	0.00461934	0.05606172	14,350
611		0.00001980	614	0.00034023	0.00453651	0.00024717	13,545	0.00457710	0.05451699	14,159
612		0.00001980	602	0.00034782	0.00490578	0.00024585	13,308	0.00466521	0.05767113	13,910
613		0.00001947	589	0.00034782	0.00490842	0.00024420	13,032	0.00464706	0.05959305	13,622
614		0.00001947	575	0.00034419	0.00460383	0.00024189	12,727	0.00457875	0.05763021	13,302
615		0.00001914	564	0.00033627	0.00409266	0.00024090	12,527	0.00446226	0.05265051	13,092
616		0.00001914	549	0.00032307	0.00357258	0.00023826	12,211	0.00428010	0.04630923	12,760
617		0.00001881	537	0.00030690	0.00384549	0.00023628	11,999	0.00406362	0.04969338	12,536
618		0.00001848	524	0.00028908	0.00391017	0.00023364	11,753	0.00383889	0.05162817	12,277
619		0.00001815	507	0.00027258	0.00375804	0.00022935	11,407	0.00374847	0.05052828	11,914
620		0.00001749	491	0.00026862	0.00343431	0.00022473	11,056	0.00378048	0.04691049	11,547
621		0.00001716	473	0.00025707	0.00347853	0.00021912	10,682	0.00365211	0.04541493	11,155
622		0.00001650	453	0.00029469	0.00346434	0.00021219	10,227	0.00380391	0.04603566	10,679
623		0.00001617	436	0.00032637	0.00329967	0.00020625	9,876	0.00429330	0.04447839	10,312
624		0.00001551	419	0.00035046	0.00333894	0.00019998	9,512	0.00466389	0.04414146	9,931
625		0.00001485	403	0.00036300	0.00335412	0.00019305	9,144	0.00488598	0.04496514	9,546
626		0.00001419	385	0.00036267	0.00324192	0.00018546	8,758	0.00494670	0.04399725	9,142
627		0.00001353	368	0.00035145	0.00324951	0.00017754	8,379	0.00484308	0.04354317	8,748
628		0.00001254	364	0.00021219	0.00300927	0.00015873	8,136	0.00270237	0.04027551	8,499
629		0.00001452	444	0.00026004	0.00421443	0.00018315	9,825	0.00348546	0.05392431	10,269
630		0.00001485	453	0.00026169	0.00435831	0.00018414	9,997	0.00352077	0.05461005	10,450
631		0.00001485	457	0.00026070	0.00428307	0.00018447	10,098	0.00352704	0.05251389	10,555
632		0.00001485	467	0.00027423	0.00398871	0.00018579	10,298	0.00374187	0.04780116	10,765
633		0.00001254	409	0.00024420	0.00284856	0.00015510	8,948	0.00323697	0.03666630	9,356
634		0.00001221	398	0.00024651	0.00319044	0.00015411	8,746	0.00331122	0.04260036	9,144
635		0.00001221	391	0.00024288	0.00335940	0.00015279	8,591	0.00330330	0.04187073	8,982
636		0.00001221	384	0.00022935	0.00367455	0.00015213	8,465	0.00316272	0.04542186	8,848
637		0.00001221	380	0.00021516	0.00386793	0.00015213	8,407	0.00291687	0.04870569	8,787
638		0.00001518	511	0.00046662	0.00309738	0.00019074	11,141	0.00637065	0.04083123	11,652



HOUSENO	STREET	PIN	NAME	ZIP	X COORD	Y COORD	ELEVATION (M)
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Non-Responsive

HOUSENO	STREET	POST-BAGHOUSE CASE				PRE-BAGHOUSE CASE				Total
		PER CONC	72-89DEP	24HR CONC	1HR CONC	PER CONC	36-72DEP	24HR CONC	1HR CONC	36-89DEP
639	Non-Responsive	0.00001254	425	0.00041349	0.00279510	0.00015774	9,278	0.00566247	0.03714711	9,704
640		0.00001254	425	0.00038940	0.00277101	0.00015774	9,280	0.00538428	0.03700389	9,706
641		0.00001254	424	0.00034947	0.00280302	0.00015675	9,241	0.00487344	0.03752529	9,665
642		0.00001254	422	0.00025872	0.00321750	0.00015609	9,173	0.00365046	0.04128465	9,595
643		0.00002409	759	0.00040986	0.00429033	0.00029799	16,586	0.00524007	0.05607294	17,346
644		0.00002739	845	0.00046134	0.00481932	0.00033660	18,513	0.00589380	0.06023193	19,358
645		0.00002640	828	0.00040392	0.00451803	0.00032472	18,081	0.00504768	0.05897661	18,909
646		0.00002640	833	0.00040326	0.00468369	0.00032406	18,135	0.00569151	0.05778861	18,968
647		0.00002640	842	0.00050655	0.00485430	0.00032604	18,343	0.00713724	0.05714577	19,185
648		0.00002673	851	0.00062832	0.00470019	0.00033033	18,553	0.00872850	0.06154830	19,403
649		0.00002673	853	0.00070323	0.00473616	0.00033132	18,598	0.00962907	0.06026922	19,451
650		0.00002046	671	0.00055638	0.00398475	0.00025575	14,638	0.00766293	0.05176875	15,309
651		0.00002046	669	0.00046101	0.00416559	0.00025509	14,575	0.00647724	0.05110050	15,244
652		0.00002046	664	0.00036993	0.00438504	0.00025377	14,462	0.00522588	0.05465394	15,126
653		0.00002145	685	0.00033330	0.00397221	0.00026466	14,945	0.00416559	0.05218026	15,631
654		0.00001947	626	0.00029898	0.00387882	0.00024057	13,672	0.00383394	0.05065434	14,298
655		0.00001518	510	0.00033726	0.00358974	0.00019074	11,098	0.00476289	0.04499748	11,608
656		0.00001485	484	0.00028677	0.00361383	0.00018777	10,623	0.00380061	0.04715832	11,106

**Attachments 4 and 5 in  
electronic format only**

Thank you for your comments on my draft air dispersion modeling study for the Western Mineral Products site. The comments will help me to improve the study so that it will better serve your needs. I would like to take this opportunity to respond to each of your comments.

**Specific Comments:**

- Page 1, 2<sup>nd</sup> paragraph: Clarification - there were two expanding furnaces, each served by a fifty foot stack (and ultimately two baghouse filters).  
*The modeled facility was characterized with two expanding furnaces, but the text was inaccurate and has been corrected.*
- Page 2, 1<sup>st</sup> full paragraph: Can you clarify or explain further why the amount of particle emissions appears to be larger than that reported in the emissions inventory reports for 1977 and 1985? Is this based on your knowledge of the specific type of baghouse filters used at the plant?  
*I have included further discussion to address this point. In short, it is a judgement call, but I deemed the operating permit and other documents to be a better source of information than the emissions inventory reports.*
- Page 2, 2<sup>nd</sup> paragraph: Would not the difference between the upper and lower bound estimates of tremolite emissions be on the order of four times, and not one order of magnitude as indicated (i.e. 15 x 1 to 20 x 3)?  
*No, the stack emissions calculations are shown in Attachment 1. The baghouse loading of 15 to 20 lb/hr of PM<sub>10</sub> is first modified by the baghouse efficiency to give PM<sub>10</sub> emissions. The PM<sub>10</sub> emissions range from 0.33 to 0.88 tons per year (tpy) for the post-baghouse case and from 9.86 to 13.14 tpy for the pre-baghouse case. These emissions are then further modified by the percentage of tremolite fibers (1-3%) to give the emission rate of the fibers. The tremolite fiber emissions range over about one order of magnitude for each of the two cases.*
- Page 2, 3<sup>rd</sup> paragraph: Is the use of one-half the rail unloading emission factor for the truck and rail loading emission factor a standard modeling assumption?  
*No, there is no emission factor for the truck and rail loading, so the selection of an emission rate is a judgement call. I assumed that since the product would be in a packaged form, the emissions would be significantly reduced, but there is no quantitative basis for*

*choosing a particular value.*

- Page 3, 4<sup>th</sup> paragraph: Please clarify the units used in Figures 4-11.  
*Done.*
- Page 3, 5<sup>th</sup> paragraph: Is there an explanation for the nearly uniform, circular pattern of the concentration isopleths? Is it related to some feature unique to the site, or is it a common occurrence?  
*The circular pattern is not especially unusual, especially for a facility with several fugitive sources such as this. The dispersion pattern from a Gaussian plume model for a single tall stack would be quite different, however, with lobes extending out in the directions of the predominant winds.*
- Page 4, Table 1: Are the deposition results per year, or total for the time period?  
*The deposition results are the total for the time period, pre-1972 or post-1972.*
- Page 5, 4<sup>th</sup> full paragraph: The tremolite ranges listed are for various waste materials produced at the plant. We do know the rough tremolite concentration in the raw ore shipped to the plant on an annual basis, which I may have provided to you in a table, and have also attached to this memo. From this data I calculated an average weighted percentage of tremolite asbestos in the ore shipped to the plant of 4.38% for the time period of 1958 - 1971, and 3.53% for the time period of 1972 - 1988. This data is useful in adjusting the emission rate from the rail unloading area (as it appears you have done), but it is unclear how it could be used to adjust the stack emission estimates.  
*The situation is as you describe, and I concur with your assessment.*
- Figure 3: The monokote mixer stack (stack 3) was likely located on the cement block building, and not adjacent to the two furnace stacks. This may or may not have any real bearing on the results.  
*I have relocated the stack accordingly, and since remodeling is required due to changes in the estimated emissions, the modified location of the monokote mixer stack will be included.*
- Attachment 1: For Stack 3, the upper bound tremolite concentration would be 3%, not 1% as listed. The lower bound is correct at 0.5%.  
*The correction has been made.*
- Attachment 2: The density of asbestos fibers as listed by EPA is 3.3 x

## Attachment 6 -- Responses to Comments

10<sup>7</sup> fibers per milligram. This should be the basis for calculating fiber concentrations in air.

*This conversion factor will be used.*

- Attachment 2: The tremolite concentration ranges for the various fugitive dust sources should be as follows:
  - Rail unloading: 3.67% to 5.16% for pre-1972 (4.38% overall weighted average)
  - 2.85% to 3.94% for post-1972 (3.52 overall weighted average)
  - Rail loading: 0.5% to 3% for entire time period (this is the tremolite concentration of finished vermiculite).
  - Waste pile: 2% to 10% for the entire time period (tremolite concentration of stoner rock pile).
  - Truck loading: 0.5% to 3% for entire time period (this is the tremolite concentration of finished vermiculite).
  - Unpaved loading area 0.05% to 8% may be a more realistic range based on additional soil samples collected in this area.

*These adjustments have been made.*

**General comments:**

- For the pre-baghouse scenario, the air pollution control equipment used was a primary cyclone with an estimated particulate removal efficiency of 85%. Would such equipment have an 85% efficiency for removal of the much smaller tremolite asbestos fibers? Perhaps a third scenario with no pollution control equipment should be run as a true "worst-case" scenario.

*It is true that a cyclone will have a greater efficiency for larger particles. The 85% value is typically applied to the  $PM_{10}$  fraction. The tremolite fibers have typical dimensions on the order of 0.5 micrometers ( $\mu m$ ) in diameter by 25  $\mu m$  in length. Since the fibers tend to align themselves lengthwise in an air flow, they might be considered to be in the smaller end of the  $PM_{10}$  range. On the other hand, since the fibers are elongated and have a greater mass than a spherical 0.5  $\mu m$  particle, it is likely that more of the fibers are removed by a cyclone than if the fibers were spherical 0.5  $\mu m$  particles. The exact cut-point for the tremolite fibers in the cyclone is unknown. One could assume some smaller removal rate, but it would only be a guess.*

- Does the model include deposition in its calculation of airborne concentrations as you move away from the plant (i.e. are concentrations reduced by the amount of deposition in addition to simple dispersion effects)?

*No, plume-depletion by deposition was not included. EPA modeling guidelines recommend against using plume-depletion for two reasons. The plume-depletion algorithm has not been well-validated, and ignoring plume-depletion gives a measure of 'conservatism' to the analysis. In addition, using the plume-depletion algorithm increases model run time considerably.*

- We would like to see units on the Figures be in fibers per cc instead of micrograms per cubic meter.

*This will be done.*

- Can a map showing total estimated deposition for the time period 1958-1988 be generated?

*This will be done.*







UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

SEP 21 2000

REPLY TO THE ATTENTION OF: SE-5J

**ACTION MEMORANDUM**

**SUBJECT:** Request for a Time-Critical Removal Action approval at the Western Mineral Products Site in Minneapolis, Hennepin County, Minnesota (Site ID # B5P2).

**FROM:** Leonard N. Zintak, Jr., On-Scene Coordinator  
Emergency Response Section 3

**TO:** William E. Muno, Director  
Superfund Division

**THRU:** -Richard C. Karl, Chief  
Emergency Response Branch

**I. PURPOSE**

The purpose of this action memorandum is to request and document approval to expend up to \$898,200 to conduct a time-critical removal action at the Western Mineral Products Site located in Minneapolis, Hennepin County, Minnesota. Specifically, the proposed removal action will address the contaminated residential properties surrounding the industrial portion of the site.

This removal action addresses the need to mitigate the threats to the local population and the environment posed by fibrous amphibole asbestos that was released into the environment from the industrial portion of the site as a result of the processing of vermiculite ore and disposal of associated waste products. High concentrations of amphibole asbestos posing a public health threat have been detected on and in the areas surrounding the former Western Mineral Products/W.R. Grace property and on the adjacent Electramatic property. These properties are herein referred to as the industrial sites. Also, high concentrations of amphibole asbestos have been detected in the residential areas (residential sites) surrounding the industrial sites.

The proposed removal action will address immediate health threats identified in the residential areas during EPA's sampling in Northeast Minneapolis which occurred from March through



August 2000. EPA plans to conduct further sampling at the residential sites which surround the industrial site and in other areas that may have been impacted by the vermiculite processing operations at the Site. This subsequent sampling, analysis and evaluation may identify additional time-critical threats at other residential sites.

This site is not on the National Priorities List (NPL).

## **II. SITE CONDITIONS AND BACKGROUND**

CERCLIS ID # MNN 000 508 056

### **A. Site Description and Background**

The industrial sites are located at 1720 Madison Street N.E. and 1815 Jefferson Street N.E., Minneapolis, Hennepin County, Minnesota, and are bordered on the east by Burlington Northern Santa Fe railroad tracks, on the north by commercial buildings and west by residential properties and a city maintenance facility, and on the south by a commercial building.

The industrial sites consist of two parcels of land, one currently owned by Madison Complex, Inc. and the other currently owned by Electramatic, Inc. The site is occupied by a three-story brick office building, a brick warehouse structure, two four-story silos, and the Electramatic building to the north. The remaining portions of the industrial sites are parking lots and an abandoned section of 18<sup>th</sup> Street that divides the two parcels of land. The abandoned section of 18<sup>th</sup> Street is now owned by Electramatic and Madison Complex.

Western Mineral Products Company, a Minnesota company, operated at 1720 Madison Street N.E. as an independent company from 1946 to 1966. During part of this time it was a licensee of the Zonolite Company, a Montana Company. W.R. Grace acquired the Zonolite Company through a merger on April 16, 1963. The property at 1720 Madison was sold by W.R. Grace to Madison Complex, Inc. on October 24, 1989 by deed dated September 29, 1989. Allegedly, in 1990, W.R. Grace removed all materials that were stored in the two silos. The property at 1720 Madison is currently leased to Panel Specialties, Inc.(PSI), which manufactures prison furniture and security equipment on the property.

The Western Mineral Products Site at 1720 Madison Street N.E. processed vermiculite

ore that was shipped from the mine in Libby, Montana. The vermiculite ore body in Libby, Montana also contained amphibole asbestos fibers of the tremolite-actinolite-richterite-winchite solid solution series (herein referred to as amphibole asbestos) (Bureau of Mines Monograph, 1928). Unlike the commercially exploited chrysotile asbestos, the tremolite-actinolite material has never been used commercially on a wide scale, and for most of the mine's operating life was considered a contaminant. The commercially exploited vermiculite was used in a variety of insulation products and construction materials, as a carrier for fertilizer and other agricultural chemicals, and as a soil conditioner.

At the mine in Libby, Montana, the vermiculite ore was strip mined using conventional equipment and then processed in an on-site dry mill to remove waste rock and overburden. Once beneficiated, the processed ore was trucked to a screening plant, which separated the milled ore into five size ranges for use in various products. From there, the material was shipped across the country, predominantly by rail, for either direct inclusion in products, or for expansion (also known as exfoliation) prior to use in products.

The Western Mineral Products site in Minneapolis, Minnesota received Libby ore by rail. Expansion of the raw ore occurred inside the building at 1720 Madison Street. Expansion was accomplished by heating the ore, usually in a dry kiln, to approximately 2000 °F, which boiled the water trapped in the crystalline matrix of the vermiculite, thus expanding the material by a factor of 10 to 15 fold. The waste product from the expansion process contained high concentrations of amphibole asbestos. This waste product, also known as "Stoner Rock", was placed outside the building in a pile and was labeled as "Free Crushed Rock". The residents in the neighborhood were encouraged to take the waste material to use as fill on their properties. Residents hauled the "Free Crushed Rock" to their homes in their pickup trucks and cars. Allegedly the asbestos contaminated material was placed in yards, gardens, sandboxes, and barbeque grills. This practice may have occurred for more than 40 years.

## **B. Removal Site Assessment**

Between February and August 2000, the U.S. EPA Emergency Response Branch conducted site assessment activities to determine the potential health threat posed by amphibole asbestos-containing wastes which were produced at the former Western Mineral Products/W.R.Grace facility at 1720 Madison and deposited outside the plant and on residential properties in the surrounding neighborhood.

As part of a national evaluation of facilities that received vermiculite ore from the Libby,

Montana mine, the U.S. Environmental Protection Agency (EPA) Region 5 Emergency Response Branch conducted an initial site visit on February 2, 2000. The initial investigation consisted of a brief inspection and sampling of the former processing building and property, and interviews with State and local officials and some members businesses operating in the area.

During the investigation EPA observed exfoliated vermiculite insulation inside the building in a ceiling area on the first floor. Also, there was visible vermiculite in the surface soils around the building. Samples were collected from these areas and were analyzed using polarized light microscopy (PLM) and transmission electron microscopy (TEM). These samples indicated trace amounts of asbestos at concentrations less than 1% by visual estimate. On April 13, 2000, U.S. EPA returned to the site to perform additional of the surface soil and indoor insulation. While the indoor samples did not detect any asbestos, the three soil samples indicated levels between 2 % and 20 % asbestos. This finding triggered additional investigatory work and also a public meeting at the nearby armory in Northeast Minneapolis on April 13, 2000. At public meeting the local residents and the news media were updated on the national and local investigation of the vermiculite sites associated with the Libby, Montana mine. At the public meeting many residents expressed their concern with the adverse health effects associated with the Western Mineral Products site. Many of the former workers from the Site have contracted asbestosis or mesothelioma, both asbestos-related diseases.

These findings led EPA to initiate a residential property investigation with the following goals:





1. Visually identify asbestos contamination in alleys and yards;
2. Sample and analyze residential areas for asbestos;
3. Conduct door-to-door community outreach to determine the extent of contamination in the residential areas around the site.

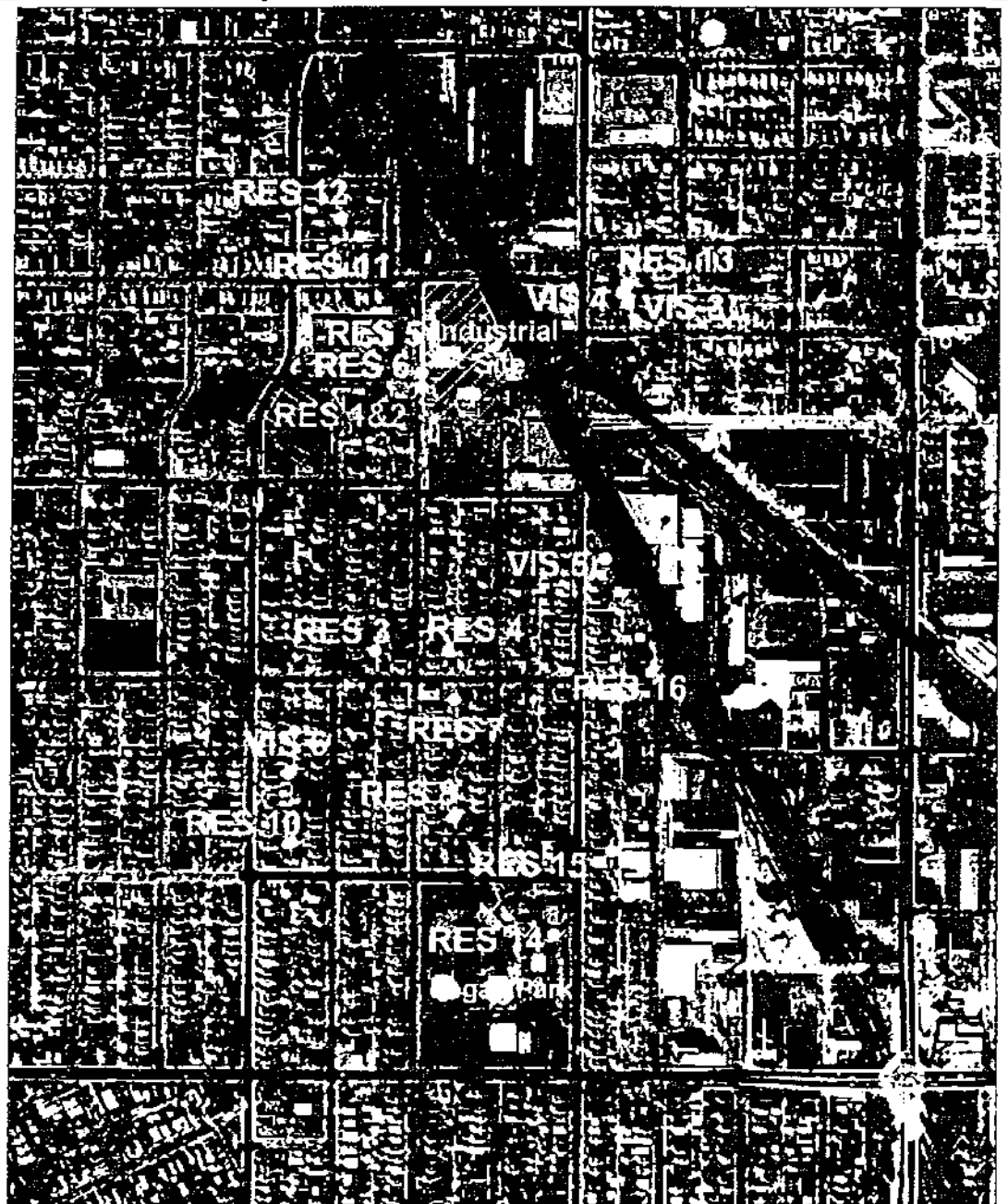
In June and July 2000, the EPA collected soil samples from alleys in the residential areas as part of the residential investigation and extent of contamination study (See Figure 1). Visible amphibole asbestos was observed and confirmed through laboratory analysis in the alleys and adjacent yards. Concentrations of asbestos as high as 95% were confirmed in samples taken from the concrete surface of the alleys. Because the Stoner Rock waste material was made readily available to the general public, EPA expects that other contaminated residences will be identified.

It has been the experience of EPA Region 8 that laboratories that were contracted to perform this analysis reported some difficulty in reading the samples due to the matrix and

# Western Mineral Site Vicinity of 1720 Madison Street NE Minneapolis, Minnesota

**Legend**

-  Grab Samples  
August 1-2, 2000
-  Grab Samples  
June 20-22, 2000
-  Visually Inspected  
August 1-2, 2000
-  Industrial Site



0.2 0 0.2 0.4 Miles



Preliminary Map  
Coordinate System  
UTM Zone 15, NAD 83

Sample Locations for August 1-2, 2000  
supported by GPS Locational Data

the long thin nature of the amphibole asbestos. As a result labs indicated that they were likely under reporting asbestos concentrations.

Asbestos is a hazardous substance as defined by 40 CFR Section 302.4 of the National Contingency Plan (NCP). Asbestos is of potential concern because chronic inhalation exposure to excessive levels of asbestos fibers suspended in air can result in lung disease such as asbestosis, mesothelioma, and lung cancer. Subacute exposures as short as a few days have been shown to cause mesothelioma. Exposures via ingestion and dermal contact are considered to be of lesser concern. Characteristics of amphibole asbestos that are of concern are in the range of greater than 5 microns in length and have an aspect ratio of greater than 5 to 1.

### **C. Community characteristics**

The Environmental Justice (EJ) Analysis indicated that the site is located in census tract 0025, block group 1, with a population of 376. To meet the EJ concern criteria, the area within 1-mile of the site must have a population that is twice the state low income percentage and/or twice the state minority percentage. For this site, the area must be at least 54% low-income and/or at least 12% minority. At this site, the low-income percentage is 55.1%, and the minority percentage is 19.7%. Therefore this site does meet the region's EJ criteria based on demographics as identified in "Region 5 Interim Guidelines for Identifying and Addressing a Potential EJ Case, June 1998".

## **III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES**

### **A. Threats to Public Health or Welfare**

The threat of exposure to residents exists through direct contact and subsequent inhalation of amphibole asbestos which is currently in the alley's and yards of residential properties around the Site. The conditions at the Site present an imminent and substantial threat to human health and the environment and meet the criteria for initiating a Removal Action under Section 300.415(b)(2) of the NCP. The following factors from §300.415(b)(2) of the NCP form the basis for EPA's determination of the threat presented, and the appropriate action to be taken:

- (i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances: The large concentrations of asbestos found in the residential alley's and in surface soils in yards indicate that the human exposure

pathway exists. In evaluating the threat posed by this exposure there are several factors to consider. The first is a historic review of the effects that have been documented by exposures to similar conditions. The second is construction of an appropriate conceptual risk model to quantitatively estimate current risks.

Given the occurrences of documented cases of asbestos related disease and death associated with handling of the ore, vermiculite product, and wastes from the Western Mineral site, it is reasonable to conclude that this known exposure pathway is an imminent and substantial threat to public health and welfare. In support of this conclusion the OSC sought and received concurrent opinions from the EPA Regional Toxicologist (see Attachment 3).

(iv) High levels of hazardous substances in soils largely at or near the surface, that may migrate; Vermiculite and pieces of amphibole asbestos are visible at the surface at both the industrial site and residential sites. Surface soils at both the industrial and residential sites contain high measured asbestos levels scattered widely over the surface of the properties. There are several pathways by which these asbestos fibers can become entrained in air leading to inhalation exposures. Contaminated soils can easily be tracked into buildings or off the contaminated properties by truck, automobile, bicycle, and/or pedestrian traffic; and then through normal activities, such as vacuuming or other air disturbance, become respirable dust. Wind, particularly in dry summer months, can lead to the migration of fine asbestos fibers from contaminated surface soils. Rainfall and snow melt would also tend to wash the fibers off of the residential yards onto the adjacent alley's and to the nearby streets and sewers where they could also become airborne.

There is documentation that in the past, area residents would remove bulk waste vermiculite that had been abandoned by Grace at the industrial site to use as fill around their homes. This has resulted in the contamination of yards, driveways, and gardens with amphibole asbestos in the area around the site and possibly on residential sites in the suburbs surrounding Minneapolis. Residents and newspaper reports indicate that from the 1940's through the 1980's children in the neighborhood played in the large pile of waste vermiculite that was labeled "Free Crushed Rock" by W.R. Grace.

Currently EPA has not established, under any of its regulatory programs, an asbestos level in soil below which an exposure does not pose a risk. The 1% cut-off level for regulation under the Toxic Substances Control Act abatement program was established on the basis of analytical capability at the time, and was not established based on the level of risk represented. To the contrary, at Superfund

sites in California EPA Region IX found in certain settings that concentrations of asbestos less than 1% posed unacceptable inhalation risks when subject to disturbance by traffic (EPA, 1994).

(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released; The warmer temperatures and dry weather typical in the summer and fall months in Minneapolis will contribute to the migration of asbestos containing soils. As soils dry out they are more likely to be transported by wind, causing the asbestos to become airborne and available for inhalation. In the spring time snow melt, rainfall, or other forms of run-off inducing events will tend to spread the contamination further from the yards to the alley's to the streets.

(vii) The (lack of) availability of other appropriate federal or state mechanisms to respond to the release; No other Local, State, or Federal agency is in the position or currently has the resources to independently implement an effective response action to address the on-going threats presented at the residential sites. EPA will conduct its actions in cooperation with State and local authorities. The Minnesota Pollution Control Agency (MPCA) is the lead oversight agency for the cleanup of the industrial site under their voluntary cleanup program.

#### **B. Threats to the Environment**

The Site investigation has not proceeded far enough to know if the asbestos contamination is a threat to animals, water, and other parts of the environment. Asbestos is primarily a threat to human health.

### **IV. ENDANGERMENT DETERMINATION**

Asbestos is a generic term for a group of six naturally-occurring fibrous silicate minerals. The predominant fibrous nature of minerals found at the Western Mineral Products Site are of the tremolite-actinolite solid solution series (referred to in this Action Memo as amphibole asbestos). Asbestos can cause asbestosis and is a recognized human carcinogen, causing lung cancer and mesothelioma, a lethal neoplasm of the lining of the chest and abdominal cavities. All of these asbestos related diseases have been found, to an unprecedented extent among former plant workers, their families, and to nearby residents with no known occupational or family connection to the vermiculite processing operations in Minneapolis. Cancer of the larynx and esophageal lining has also been associated with exposure to asbestos. Commercial forms of asbestos have been found to be carcinogenic in experimental animals.



Actual or threatened releases of asbestos from this Site, if not addressed by implementing the response action selected in this Action Memorandum, present an imminent and substantial endangerment to public health, welfare, and the environment.

## **V. PROPOSED ACTIONS AND ESTIMATED COSTS**

### **A. Proposed Actions**

To mitigate the threat to the public health and welfare or the environment posed by the asbestos present on the residential properties, the proposed removal actions are outlined below. The removal will involve the following:

- a. Develop and implement a site health and safety plan;
- b. Determine the horizontal extent of asbestos contamination in the contaminated residential sites and identify areas to be remediated;
- c. Excavate and remove asbestos contaminated soils to a maximum depth of 18 inches in the yards and alley's;
- d. Dispose of contaminated soils at an EPA-approved off-site disposal facility;
- e. Remove and dispose of asbestos from the surface of the paved alley's and driveways;
- f. Perform personal air sampling and ambient air sampling during remediation activities;
- g. Implement engineering measures to control dust during the cleanup;
- h. Install a synthetic liner at the bottom of the excavated area prior to backfill;
- i. Analyze bulk asbestos samples using standard Polarized Light Microscopy (PLM) methods. Supplement PLM analysis with Transmission Electron Microscopy (TEM) for samples with lower concentrations of asbestos to assess whether contamination is present and whether sufficient excavation has occurred;
- j. Backfill excavated areas with clean soil and restore property to original pre-removal condition;

It is estimated that each residential property will take approximately an average of 1.5 days of on-site work time to remediate. This project is estimated to take 40 days to complete assuming that 30 residential properties require remediation.

For the purposes of this initial removal action, cleanups will be initiated at properties with asbestos contamination levels of 1% or greater. Surface soils with detectable levels of contamination will be removed. The excavation depth will be approximately 18 inches.

In accordance with Section 300.415(l), EPA will pursue appropriate arrangements for

post-removal site controls at the disposal site to ensure the long-term integrity of the removal. EPA has not yet made a decision regarding NPL listing for the Site. The proposed removal actions should compliment and contribute to the overall success of any remedial actions in the future.

As this cleanup is being conducted as a Time-Critical Removal Action, all Federal and State ARARs may not have been identified at this time. In accordance with the NCP, all ARARs for the Site will be attained to the extent practicable, given the scope of the project and the urgency of the situation as they are identified.

Many of the ARARS identified for these Removal Actions come from the Clean Air Act National Emission Standards for Hazardous Pollutants (NESHAPS) for asbestos. These regulations were designed specifically for renovation and demolition of buildings with asbestos containing material (ACM) such as floor tile, ceiling tile and pipe wrapping. The regulations were not designed for piles of unexpanded vermiculite, contaminated soils, or heavily contaminated dust. As such, it is anticipated that it may not be practicable to achieve all ARARS during this Removal Action.

#### **B. Estimated Costs**

The following cost estimates include costs associated with the residential removal actions for purposes of creating a total project ceiling. These costs are being estimated anticipating that the project will need to be performed as a fund lead action. The costs do not include any past or future investigation costs on the Site. Costs are projected as follows:

##### **EXTRAMURAL COSTS**

Cleanup Contractor Costs	\$ 645,000
Contingency (15%)	\$ 96,750
Subtotal	\$ 741,750
START	\$ 30,250
Extramural Subtotal	\$ 772,000
Extramural Contingency (10%)	\$ 77,200
TOTAL, EXTRAMURAL COSTS	\$ 849,200

#### **INTRAMURAL COSTS**

U.S. EPA Direct Costs \$30 x (500 Regional Hours + 50 H.Q. hours)	\$ 16,500
U.S. EPA Indirect Costs \$65 x 500 Regional Hours	\$ 32,500
TOTAL INTRAMURAL COSTS	\$ 49,000

**TOTAL PROJECT CEILING** \$ 898,200

A detailed cleanup contractor cost breakdown is available as Attachment 1.

#### **VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN**

Delayed action will increase public health risks to the local population/environment posed by asbestos fibers in the residential alleys and yards.

#### **VII. OUTSTANDING POLICY ISSUES**

Asbestos removals have been completed in Region 5, and around the country at numerous removal sites which were initiated under Section 300.415 of the NCP and in compliance with NESHAPS regulation under 40 CFR Section 61.150. This removal does not set a precedent or constitute a nationally significant issue. Because of the potentially broad impact of the vermiculite ore with high levels of amphibole asbestos mined from the Libby, Montana deposits, EPA Region 5 is coordinating with EPA Headquarters and other regions to assure a consistent approach to vermiculite issues.


#### **VIII. ENFORCEMENT**

For administrative purposes, information concerning the enforcement strategy for this Site is contained in the attached Enforcement Confidential Addendum.

## IX. RECOMMENDATION

This decision document represents the selected initial Removal Action for the residential portion of the Western Mineral Products Site, located in Minneapolis, Hennepin County, Minnesota, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. This decision is based on the Administrative Record for the Site. Conditions at the Site meet the NCP §300.415(b)(2) criteria for a Removal Action, and your approval is recommended. The total project ceiling, if approved, will be \$ 898,200. Of this, \$ 818,950 may be used for cleanup contractor costs. You may indicate your decision by signing below.

APPROVE: \_\_\_\_\_

*for*   
William E. Muno, Director  
Superfund Division

Date: \_\_\_\_\_

7/21/00

DISAPPROVE: \_\_\_\_\_

William E. Muno, Director  
Superfund Division

Date: \_\_\_\_\_

### Attachments:

- Figure 1 - Site and Residential Sample Location Map
- Attachment 1 - Cleanup Contractor Costs
- Attachment 2 - Administrative Record Index
- Attachment 3 - EPA Toxicologist's Memorandum
- Attachment 4 - Confidential Enforcement Attachment
- Attachment 5 - Environmental Justice Analysis